THE CITRUS INDUSTRY

A TEXT FOR USE IN THE
JUNIOR-SENIOR HIGH SCHOOLS

DAVID REA LANGFITT

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THE CITRUS INDUSTRY

A Text for Use in the
Junior - Senior High Schools

DAVID REA LANGFITT

Submitted in partial fulfillment of the requirements for the degree of Master of Arts to the Faculty of the Graduate School
Florida Southern College

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APPROVAL SHEET

Title of Thesis: [illegible]

Candidate's name: [illegible]

Master of [illegible]

Degree and year: [illegible]

READERS:

1. [illegible]

2. [illegible]

ADVISOR:

[illegible]

(Major - Optical Physics; Minor - Physics; Minor - Philosophy)

Graduate School

1. Oral Examination:

   a. Study of underwater optics - Dr. [illegible]

   b. The optical properties of sea water - Dr. [illegible]

   c. The study of fine structure - Dr. [illegible]

   d. The development of underwater photography - Mr. [illegible]

Personal Data Sheet

Name: David Rea Langfitt Age: 29

Present Address: 303 Kenwith Rd., Lakeland, Florida

Telephone: 87-324 Status: Married - 2 children.

Permanent Address: 303 Kenwith Rd., Lakeland, Florida

Education:

Undergraduate Level

1. Washington & Jefferson College, Washington, Penna. 1936-1941
2. University of Pittsburgh, Pittsburgh, Penna. Summer 1939.
3. Columbia University, New York, N. Y. Summer 1940.

B. S. in Pre-Med., Washington & Jefferson College 1941
(Major - Chemistry - biology; Minor - Philosophy)

Graduate Level

1. Naval Research
   a. Study of underwater optics - Dr. E. O. Hulbert
   b. The optical properties of Sea Water - Dr. S. Q. Duntley of Massachusetts Institute of Technology.
   c. The study of mine camouflage - Cap. C. Bittinger USN
   d. The development of underwater photography - Lt. Commander E. H. F. Johnson.

Work Experience:

1. Four years in the Naval Research during World War II.
2. Pittsburgh Plate Glass Co. Research Laboratories - 1945.
3. University of Florida, Citrus Experiment Station - 1946.
4. Florida Southern College, Research Laboratories - 1947-8

Teaching Experience:

1. Summer tutoring - 1947 (Elementary grades).
2. Underwater photography - Bureau of Ordnance - 1944-45.
3. Surface Navigation - 1945 (South Pacific).
4. Applied Agriculture - Florida Southern College 1947.

Service Experience:

1. Apprentice Seaman - USS Wyoming - Summer 1940.
2. Midshipman - Columbia University 1941.
3. Ensign, Commanding Officer YP 75 Sub chaser - 1941.
4. Lt. (jg) - Commanding Officer USS John M. Howard Research vessel for Naval Research - 1943 - 1945.
5. Lt. Commander - Navigator USS Prairie - Pacific 1945.

Other Experience:

1. Industrial Research - Pittsburgh Plate Glass Co. - 1946.
2. Research Chemist - University of Florida Citrus Experiment Station.
3. Director of Research - Florida Southern College, Citrus Research Laboratory, 1948.

Writings and Research:

1. A paper on The Optical Density of Sea Water. Unpublished - located in U. S. Navy confidential files.
2. The Development of a Method of Measuring Turbidity of Sea Water by Electronics. Unpublished - located in U. S. Navy confidential files.
3. A Study on the Use of Filters in Underwater Photography. Unpublished - located in U. S. Navy confidential files.
4. Investigations on the Use of Infra-red in Underwater Photography. Unpublished - located in U. S. Navy confidential files.
5. Subsurface Photographic Survey of the Ocean Bottom. Unpublished - located in U. S. Navy confidential files.
6. A Study of the Underwater Optics, Including the Use of Lighting Filters and Flash Bulbs. Unpublished - located in U. S. Navy confidential files.
7. A Study of the Progressive Variation in Color of Coral with Increase in Depth. Unpublished - located in U. S. Navy confidential files.
8. Development and patent of the Chemical Deposition of Silver on Plastic CR-39. Pittsburgh Plate Glass Co., Pittsburgh, Penna.

9. A Study of the Chemistry of Synthetic Detergents for Use in the Citrus Industry. Unpublished - Citrus Experiment Station, Lake Alfred, Florida.

10. Development of a Method for the Detection of Vitamin P in Citrus Products. Citrus Research Laboratory, Florida Southern College, Lakeland, Florida.

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The Problem

General Statement

The purpose of this investigation is to prepare a text for the public school student which presents a clear picture of the Citrus Industry, its magnitude, and multivarious parts which make it one of the most interesting industries of today.

Specific Problem

The specific problem is to investigate, exemplify, and present Florida's greatest industry, so that a better understanding may be presented to the coming generation in our schools.

Definition of Terms

The term "industry" as used in this text refers to the production of citrus, and the citrus by-products. Specifically it implies the application of the principles and practices related to citrus growing, cultivation, packing, marketing, and by-products of the citrus industry. The term "citrus" as used in this text refers to fruits of the orange, grapefruit variety.

Preface

Author's Note

I'm not sure if this is a preface or an introduction, but I'll just call it what I want. I've been working on this book for a long time, and I've had many different versions of it. I'm not sure if I'll ever be completely satisfied with it, but I'm getting close.

Publication History

This book was originally published in 1995, and was my first attempt at writing a novel. I'm not sure what I was thinking, but I'm glad I did it.

Publication of Thesis

This book was originally my thesis for my master's degree in creative writing. I'm not sure if I'll ever be able to write anything else like it, but I'm glad I did it.

Delimitations

The study of citrus as presented here is limited to such aspects as the history and the function of the grower, packer, shipper, and canner and their relation to the industry in Florida.

Basic Assumption

It is felt that the students of the public schools should be made aware of the largest industry in their home state. For this reason the author has undertaken the task of preparing a dynamic text on the citrus industry for use in the junior and senior high schools or in the agricultural department of the vocational arts program.

Basic Hypothesis

The investigator presents a text based on the following principles:

1. To present to the secondary school student an overall picture of the magnitude of the citrus industry.

2. To elaborate on specific phases of the industry, such as processing and marketing of citrus fruits.

   (a) The relationship of grower to packer, and packer to buyer.

   (b) Present marketing methods of citrus as practiced in the business world today.

Definitions

1. The study of ethics or morals is known as
such aspects of the history and function of
person, subject, and conduct and their relation to the
industry in Alaska.

Basic Assumptions

It is not the purpose of this study to
attempt to establish a standard industry in Alaska
of responsible dynamic ethics in the fishing industry. Rather
in the junior and senior high school or in the agricultural
department of the vocational area chosen.

Basic Hypothesis

The investigator presents a test based on the
following hypothesis:

1. To attempt to use the study as a model for
overall picture of the results of the ethical behavior.

2. To disperse an objective opinion of the industry.

3. To encourage and motivate better ethical behavior.

(a) The following is known as moral, and
which is known.

(b) Present practices which are ethical
practiced in the business world today.

3. Presentation of some of the problems confronting the industry today.

The Need for the Study

The only modern book on citrus today being that written by Batchelor and Webber[1] of California. This book although an excellent volume is far too technical for consumption on the junior and senior high school level. This completed work provides a text of material in a form which can be used by the average secondary school student, so that he may acquire a knowledge of one of Florida's greatest industries.

Incidence of the Problem

Reasons for selecting this problem has come through the author's intimate relationship and observation in the citrus industry as a scientist and educator. Because of contact with the industry it is felt that a text for use in the secondary schools would be most beneficial in helping our youth to better understand the magnitude of one of Florida's largest industries.

Related Literature

The existing literature was surveyed on citrus, and

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[1] Webber, H. J. and Batchelor, L. D. Citrus Industries Berkley University of California Press, 1948, Vol. I.

a survey of existing conditions in the citrus industry. The basic principle upon which this text is to be written is based on the fundamental principles of the functions of the citrus industry in Florida.

Procedure in Collecting Data

The data was gathered from the present literature, such as state publications, industry reports, lectures of citrus growers, packers, shippers, and from discussion of this problem with prominent citrus men in the industry.

INTRODUCTION

The production of citrus fruit is the leading agricultural industry in Florida and is the basis for a large citrus products manufacturing industry and a large container industry. In short, much of the business life in Florida is based on the production, distribution, and sale of citrus. For the 1946-1947 season, Florida's production of oranges, grapefruit, and tangerines showed an increase of a little less than one and one-half million boxes over the preceding year. Early and midseason oranges were reported at 20,300,000 boxes; Valencias, 23, 00,000; tangerines, 4,700,000; seedless grapefruit, 14,000,000; and seed grapefruit, 10,000,000 for a grand total of 87,400,000 compared to 86,000,000 in 1945-46. The total production of oranges, grapefruit, and tangerines for the United States was 179,130,000 boxes.

The citrus industry has grown since 1800 from the small truckload shipment to northern cities around Christmas time as a luxury item to a multi-million dollar business. In fact, a 100,000,000 dollar-a-year business. The reasons for this amazing development are many. It is evident that oranges and grapefruit are now classed as staple fruits, which are desirable for proper development of the physical health both in children and adults. The

glass or orange juice or half of grapefruit for breakfast in the morning has become a national institution in the American home today.

It is hoped that this text may be of some help in bringing to the eyes of our youth of today the magnitude of this all-important industry. Also, the intimate part which the youth of Florida play in this industry. National statistics show that one working man out of every ten in the United States receives his living from the food industries.

Florida now ranks first in the production of grapefruit, a worthy second in oranges, and first in the total production of oranges, grapefruit, and tangerines combined. Thus, it can be seen the magnitude and importance of the citrus industry and how intimately it relates to our everyday lives.

CHAPTER I

HISTORY OF CITRUS

The origin of citrus dates back many hundred of years, having its early origin in Asia and the Malay Archipelago. The citron was described by Theophratus in 300 B. C. Oranges and lemons were known in China before the 12th century, and known in Europe at the beginning of the 15th century, and in the Americas about the 16th century. The pumelo or early grapefruit was known in China about 2205 B.C., and in Europe in the 17th century. The citron being the oldest known member of the citrus family to be described, was mentioned in Mesopotamia around 4000 B.C. Marco Polo in his travels introduced the orange into India in the 13th century. In fact the lime has its origin in India.

Interest in the early history of citrus fruits has been awakened in recent years by new facts brought to light bearing on their original introduction into the New World. Perhaps chief among these discoveries is that Columbus, on his second voyage, was the bearer of seed that gave rise to the first citrus orchard in America. Credit for this important find is due to Virginia Kift Barns[1], who published

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[1]Barns, V. K., Florida Historical Quarterly - Tallahassee, Vol. XV, No. 4, April 1937.

an account of her discovery in a Florida journal, "The Citrus Industry", October 1934. Up to that time no record existed in American literature of the exact date or manner of introduction of citrus into this part of the world. In the course of a survey on raw products carried out by the New York Department of Markets, Miss Barns consulted Bartolomez de las Casas "Historia de las Indias". This history, written over a period of years (1527-1559), remained unpublished until 1875, when it was finally printed in Spanish. Only parts of this work have been translated into English. The portion with which we are concerned is worth considering in some detail. Referring to Columbus's second voyage, Las Casas tells of his departure from the Bay of Cadiz on September 25, 1493, and the stop at the island of Gomera, one of the Canary group (October 11 to 13) awaiting favorable winds. There he bought seed and livestock, including eight pigs. Las Casas writes:

> "From these eight pigs there have multiplied all the pigs which unto this day inhabit the infinite Islands of all the Indies. They bought hens and also grains and seeds of oranges, lemons, citrons, melons, and all kinds of garden vegetables, and this was the origin of everything that there is today of the things of Castille."

Thus, the exact date of introduction and the exact spot in the Old World--Gomera in the Hesperides, or Canary Islands--from which our first citrus came were both recorded by the Spanish Friar.

Las Casas goes on to relate that on November 28, 1493, Columbus sighted the Island of Hispaniola (this is, Haiti, also called San Domingo), and

> "there he unloaded his ships of provisions, livestock and materials, built a fort, and a church and storehouse, set out orchards, plant d gardens, and with great diligence erected a new city."

This city was named "Isabella", and was located on the north side of the island, not far from the present town of Monte Cristo in San Domingo.

That the citrus seeds sown by Columbus sprouted and prospered we have no reason to doubt. We have, in fact, Herrera's[2] statement regarding Hispaniola and how well it had proved suited to the Negroes imported from Africa: "Like oranges, they found their proper soil in Hispaniola and it seemed even more natural to them than their native land." Also we are told by the naturalist Oviedo, who was in Hispaniola from 1514 to 1556, that "Orange trees from Castile were brought to the Island of Hispaniola and they have multiplied so abundantly that they are not past counting; the fruit is very good, both sweet and sour". Thus, the spread of citrus must have been very rapid in the two or three decades following the introduction by Columbus. Doubtless Hispaniola thus served as a distributing center

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[2] Herrera - Florida Historical Quarterly - Tallahassee, Vol. XV, No. 4, April 1937.

for the neighboring islands of the West Indies, for the mainland of the Americas and possibly for Florida, though there were, of course, later introductions direct from Spain. Just when and by whom citrus was first introduced into Florida remains to be discovered. Perhaps a plain statement may repose in some neglected manuscript or publication, or did the long-buried record of Columbus' part in bringing citrus seeds to the New World.

It is said that in 1577 Bartolome Martinez, in a letter to the Spanish King, states that he planted with his own hand orange and fig trees at Santa Elena, located on the North Carolina coast. Also, in April 1579, Pedro Menendez Marques, reporting progress at St. Augustine, states, "there are beginning to be many of the fruits of Spain, such as figs, pomegranates, oranges, grapes, in great quantity". This would indicate that the citrus had been introduced earlier, possibly by as much as several decades. However, Hume[4] is of the opinion that the introduction of the citrus fruits into Florida did not antedate 1565, the year in which St. Augustine was founded. Certain it is that St. Augustine and its environs gradually became one vast orange grove, with schooners carrying loads of the golden fruit to the northern coastal cities over 200 years ago.

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[4] Hume, H. H. The Cultivation of Citrus Fruits, N. Y. 1916

It is doubtless true, as Hume[5] states, that the introduction into the St. Augustine area was by seed rather than by grafting or layered plants. In the case of citrus that fact would not be as great a handicap as it might be with nearly all of the other important tree fruits of the world, seedlings of which commonly give rise to plants of inferior and widely divergent fruiting types. In fact, the citrus group and one race of mango are the only important types of tree fruits known that in the vast majority of instances "come true from seed". This is because their seeds develop extra embryos derived from the mother tissue of the seed, the nucleius, these extra embryos being, therefore, genetically the same as buds taken from the mother plant. Even more remarkable is the fact that sprouts from these extra embryos frequently, and in some varieties entirely suppress or supplant those springing from the true or seminal embryo, so that the resulting population resembles the seed parents in all essential characters. This important fact was not recognized until 1878, when Strassburger announced the polyembryonic nature of citrus seed. It doubtless accounts for the fact that there is a remarkable uniformity, generally speaking, in the fruits produced by the old seedling groves that still furnish an

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[5]Ibid[4]

important part of the Florida orange crop. These seedlings doubtless trace their ancestry back to a very few parent orange trees that survived the disastrous freeze of 1835, which all but wiped out the sweet orange groves of Florida.

The Dummitt orange grove on Merritt's Island, opposite Titusville, was one of the few surviving groves after that truly great freeze. This grove was unique in that it was not a seedling grove but was composed of top-worked or grafted on sour orange rootstocks at a height of three feet from the ground. The grafting took place about 1880. That they were grafted trees was discovered when a citrus grower visited the grove in 1926. The graft union was plainly shown in photographs taken at that time, and reproduced in an article on the history of the grove published in the Proceedings of the Florida State Horticultural Society for 1926. These photographs have also been republished in the recent monumental work on the citrus industry edited by Webber and Batchelor[6]. It is pointed out that this was probably the first instance of the working over of a wild sour orange grove; the using of such volunteer trees as grafting stocks did not become a general practice until

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[6] Webber, H. J., and L. D. Batchelor, The Citrus Industry. Vol. 1. (Berkely and Los Angeles University of California Press). 1943

about 1865 or 1870. Despite the fact that this old grove has reverted to a jungle condition several times in the past century, there were still some trees alive according to the last report. These veteran survivors of a past era should be promptly acquired and cared for by some official State organization, possibly the Florida Forest and Park Service. It is safe to say that if California could boast of such historic trees they would constitute a shrine to be visited annually by throngs of citrus growers and other visitors.

Notwithstanding the mass uniformity of citrus seedlings, enough variation has arisen, due to mutation or possibly hybridization, to give rise to the most valuable orange varieties grown in Florida today. In fact, the Valencia orange is the only budded variety of sweet orange widely grown in this state that is direct importation from the Old World. Such varieties as the Parson Brown, Pineapple, Hamlin, Homosassa, Enterprise, and Conner, which constitute the great bulk of Florida shipments (exclusive of Valencia and seedling oranges), owe their origin to selected seedlings propagated by budding. The practice of budding was in many instances resorted to in order to utilize as rootstocks the so-called "wild" sour oranges that had sprung up as volunteers, forming thickets along such streams as the St. Johns and Oklawaha rivers.

Indian camping and hunting parties are generally credited with the spread of these "natural groves", the fruit and seeds dropped by them around their camp sites giving rise to large colonies of descendants in the course of time. One such a grove in the Okaloacoochee Slough of the Everglades is estimated to have produced the equivalent of 10,000 boxes of sour oranges annually--until overdrainage and subsequent fires practically destroyed it. It is no wonder that some early visitors to Florida thought that oranges were native to the state, when they saw such "wild" trees competing with bays and cypresses for the possession of low rich ground.

Returning to the seeds brought to the New World by Columbus, it will be recalled that no mention is made of grapefruit, Florida's unique contribution to the citrus markets of the world. Not only was grapefruit as we know it unknown to the Old World in Columbus' time--it was and is practically to this day unknown in the Orient, whence all our other citrus fruits originally came. The nearest counterpart to grapefruit in the Orient is the pummelo or shaddock, a native of the islands of the Malayan Archipelago and Polynesia. The name "shaddock" was used in the West Indies for the large, thick-skinned pummelos, because a certain Captain Shaddock was credited with having brought the seed from the East. The fruit was first

planted in Barbados late in the 17th century. The shaddock was grown chiefly as a curiosity, although some of the Oriental varieties are highly esteemed in their native lands. It now appears likely that it was from the shaddock that the New World acquired the wonderful fruit that we call grapefruit, by mutation or perhaps through chance hybridization.

Grapefruit is first mentioned, under the name "forbidden fruit", as occurring in Barbados by Griffith Hughes[7] in 1750, and is recorded from Jamaica as "forbidden fruit or smaller shaddock" by Patrick Brown in 1789. In 1814 John Lunan used the name "grapefruit" in his Hortus Jamaicensis. Despite efforts to change the name to "pomelo" the name grapefruit has come into wide use and seems certain to persist. Although for a long time grouped with the pummelos, grapefruit is now recognized as a distinct botanical species. One fundamental difference between grapefruit and shaddocks is the fact that the latter are unique among citrus fruits in having seeds with but a single embryo, while grapefruit seeds are polyembryonic. This would seem to indicate that grapefruit arose through hybridization between a shaddock and an orange, the polyembryonic character of the orange

[7]Hughes, Loc. cit.

being dominate. The U. S. Department of Agriculture has attempted by crossing to re-create grapefruit, but thus far without success. This is not surprising, since the chances of striking the same combination of characters in a limited number of hybrid seedlings is after all remote.

The merits of the new fruit were apparently appreciated by a select few, but it failed to meet so ular approval for a surprisingly long time. Introduced into Florida about 1809 by Don Phillippe, a Spanish nobleman located near Safety Harbor on Old Tampa Bay, it spread slowly but was grown chiefly as a curiosity or for home use. Not until winter visitors from the North developed a liking for grapefruit was any trade in it established. This happened sometime between 1880 and 1885, the first shipments north being made in barrels that netted about fifty cents per barrel. Only with the coming of the present century did grapefruit really begin to command a place in the fruit markets of the nation. Once started, the demand increased at a pace hardly paralleled by that shown by any other newly-introduced fruit.

An important contribution to the world-wide popularity of grapefruit was the discovery in Florida of a seedless variety generally known as the Marsh Seedless, named for the man who initiated its propagation and distributed it from his Lakeland, Florida nursery. The parent

tree, a seedling, grew in the grove of William Hancock at Socrum, about 12 miles north of Wauchula, Florida. It was a bearing tree when Hancock bought the place in 1863, and was in a decadent condition when the freeze of 1894-95 killed it. Propogation had, however, been started by several persons about 1885, although the value of the variety was not fully appreciated for another 30 years. The Marsh Seedless has been predominant variety in practically all recent plantings, and is almost the only one grown in the Southwest and in foreign countries that have taken up the growing of grapefruit recently.

A further impetus to grapefruit consumption was furnished when it was discovered, at the time of World War I, that grapefruit would lend itself to canning, making it available for use the year around. How important that fact has become may be realized when it is stated that in recent seasons processed grapefruit has accounted for fifty per cent or more of the total production in Florida. Of course, the demand growing out of the requirements of the Armed Forces and Lend-Lease has had an important bearing on this as one-third of the crop went into cans.

Another contribution that Florida is at the present time making to the citrus situation is the outgrowth of a breeding program initiated by the U. S. Department of Agriculture in 1893, over half a century ago. At that time

Swingle[8] and Webber[9], in the attempt to create hardier sweet oranges, made numerous crosses between the trifoliate orange and the common sweet orange. Many hybrids, called "citranges", were produced, but none that would serve as true orange substitute. The program of research was gradually expanded until hybrids had been secured between practically all the main species and varieties of true citrus, and involving some of the more closely allied citrus relatives--an accomplishment unparalleled in the field of subtropical horticulture. The particular hybrid that is now making its debut is that between the grapefruit and the tangerine, known as the tangelo. Thousands of seedlings were grown and tested to secure a half dozen tangelo varieties suited to commercial handling, and maturing at different periods so that tangelos might be available practically throught Florida's shipping season. Their high color of flesh and of peel makes them attractive to the eye, and they bid fair to take an important place in the citrus market, particularly in the fancy fruit and private order trade. The Temple orange, evidently a natural hybrid, should doubtless be classed with the tangelos, which it resembles in many respects. Thus far

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[8] Swingle, W. T., Citrus standard Cyclopedia of Horticulture, 2: 780-785.

[9] Webber, H. J., Citrus Industries, Vol. I, Berkley 1948.

the tangelos have not appeared very well suited to other citrus regions of the United States, so that Florida may prove a practical monopoly on this fruit, as it has of the tangerine.

No discussion of citrus developments in Florida would be complete without some mention of the social effects of what may be termed the industrialization of citrus handling. Time was, within the memory of many of us, when a good part of the fruit leaving Florida was packed by the grove owners themselves, in crude packing sheds and with still more crude equipment. The labor for picking and packing was recruited from the immediate neighborhood, and the payroll thus locally distributed was a potent factor in building up fairly prosperous rural communities.

With the passing of the local car-a-day packing house, and the centralization of fruit handling through very large and well-equipped packing houses serving a wide territory, the picture has greatly changed. The labor of picking and packing has gradually passed into the hands of migrant workers, and the effect may be seen in the decline of some of our rural communities. Greater efficiency both in packing and marketing is certainly attainable through the present centralization, but it is desirable that the social problems arising therefrom should be recognized and that counter measures be taken wherever possible. It is important that a large proportion of our rural youth should find

their surroundings sufficiently attractive and their employment sufficiently remunerative to make them desire to follow the horticultural pursuits of their fathers, instead of drifting to the cities, or perhaps becoming migrant laborers themselves.

CHAPTER II

VARIETIES

Innumerable varieties of citrus have been developed in Florida, but there has been a tendency to standardize on fewer varieties in the last 20 years so that today new plantings are limited to relatively few varieties. Most of the older varieties are now shipped with the modern varieties which are most nearly like them and not under their original name.

Varieties of oranges fall into three general classes: Early varieties which will pass maturity test, provided by law, during late October and November; midseason varieties which are shipped during December, January, or February; and late varieties which are ready for shipment about March 1st and are shipped up to early summer. Grapefruit varieties are less well-defined as to season but were formerly classed as early and late varieties, although this classification has been largely done away with through the shipping of March Seedless during the early season. There is not in grapefruit the distinct seasonal ripening that is recognized in oranges. A description of the standard commercial varieties is given below:

Oranges

Early Varieties:

PINEAPPLE is one of the older varieties, originating about 1878 in a seedling grove at Glenwood which belonged to Parson Brown. It was widely planted following the freezes of 1894 and 1895. The fruit is of relatively large size, has 10 to 12 seeds, and a fairly coarse textured flesh and a deep yellow juice. The peel is slightly rough or pebbly, and tends to remain dark green rather late in the fall, although the color "breaks" readily in the coloring room. It is shipped mostly in October and November but under modern cultural practices has been found to carry well into December and January with improvement in quality during the prolonged period on the tree. The tree is very vigorous with a pronounced upright growth, easily grown and quite resistant to cold. Production is heavy, and it is the most widely grown early orange.

HAMLIN is one of the newer varieties. It originated in a grove planted in 1879 near Glenwood, Florida, but has been planted extensively only in recent years. It is rather a small orange, slightly oval, with a very smooth and fine textured skin, usually seedless, although 1 to 5 seeds may occur in occasional fruits. The fruit develops sweetness very early in the fall. When originally grown on

rough lemon, the pulp tends to be dry and ricy, but this has been overcome by changes in fertilizing and spraying, and excellent quality fruit is now produced on rough lemon stock as well as on sour orange stock, and the fruit can be held through January if fertilization and spraying are properly carried out. The chief disadvantage is the small size of the fruit as compared with the Parson Brown and the very tender skin which is easily injured by sprays and adverse weather.

Midseason Varieties:

PINEAPPLE is the most widely grown midseason orange and is usually round or slightly oblate with 15 to 20 seeds. It originated near Citra and has been planted more widely than any other midseason or early orange since the freezes of 1894 and 1895. It is noted for the very deep red color of the peel when fully ripe and the rich flavor of the juice.

JAFFA is round to slightly oblong and is usually rather large in size with an orange-red peel. It was imported into this country from Palestine about 1885 and has been extensively planted on heavy soils. The fruit has an excellent flavor with abundant deep orange-colored juice and only 6 to 9 seeds. It usually passes the

maturity test a little earlier than the Pineapple but will hang on the trees satisfactorily throughout midseason. The tree is very vigorous with a peculiar upright habit of growth in which the branches tend to be upright rather than lateral or nearly lateral as in other varieties. The leaves are also more thickly placed on the twigs with a peculiar form of overlapping which tends to distinguish it from other varieties. The tree is very resistant to cold. Plantings have been increasing during the last few years.

SEEDLINGS. In the early history of Florida, citrus production was based very largely on extensive seedling groves, and while no considerable acreage of seedlings has been planted for many years, the seedling groves that are still in existence furnish a very substantial portion of the tonnage of fruit. The fruit is usually large with a smooth rind which is slightly more loose in relation to the pulp than is characteristic of most budded varieties. The acid and sugar content of the fruit is high and the juice of excellent quality, the number of seeds varies but usually 20 or more per fruit. Seedling groves are very heavy and consistent producers until they are neglected and start to decline. While it is unlikely that any considerable additional acreage will be planted, they still

constitute a very large portion of plantings.

[illegible]. The fruit is [illegible] because it is usually shipped as an orange, although it is probably a hybrid between a sweet orange and some variety of mandarin. It was found on the old Tindel property at Vero and was first introduced to the trade by the Waldo Fruit Co. in 1917. It is an oblate orange, usually tapering slightly to the stem; medium in size having a deep red color in the rind and a deep orange-colored flesh and about 12 locules. The flavor is different from that of the ordinary sweet oranges, and the pulp and juice have a characteristic aroma. The rind is usually thin and may be smooth or pebbly, resembling both the fertilizer orange and the pointbock; it separates very easily from the pulp which is characteristic of most Florida oranges but not quite so easily as the tangerine. It is the finest orange for eating from the hand. Its season is slightly later than the ordinary midseason orange with the first fruit usually going to the Christmas market but the best quality being obtained from January to March.

Late Varieties:

VALENCIA has been the standard late variety for many years, although it is probably that several slightly

different strains of the Valencia have been involved. There were at least two original introductions into Florida in the early days. One of these was known as Hart's Late or sometimes Hart's Tardiff, and came through an Eastern nursery. The other came from California but was probably from the same source as the introductions originally made into Florida. The Valencia is usually oval, medium to large in size, with a deep orange color when fully ripe and an orange-colored flesh. Fruits are usually fine in texture, over size, and the juice is of very excellent quality. It is now shipped from late March to July and with the improved fertilizer practices the season will probably be extended into the summer. The tree is vigorous and quite resistant to cold, and does well on most combinations of stocks and soils. It constitutes the main crop of late oranges in Florida.

LUE GIN KING. This orange is one of the newer late varieties, and was introduced about 1914. It is thought to be the result of hand pollination of the Valencia with pollen from the Mediterranean sweet by a Chinese, Lue Gim Gong, who resided near DeLand. The variety has been presumed to be superior to the Valencia with more cold resistance in the tree and somewhat better color of fruit and also a longer season. As grown domestically it

more

has been impossible to definitely separate it from the Valencia. The fruit is large and oblong, contains about six seeds, and the flesh is a deep orange color and of good quality. The season is the same as that of the Valencia.

Grapefruit

The original seedling grapefruit groves in Florida produced fruits with a large number of seeds, and innumerable selections of varieties have been made from these groves in which the number of seeds varies from 30 to 60 per fruit. Unfortunately, these varieties have not been clear-cut in their characteristics, and considerable carelessness has developed in their classification and segregation in groves so that it is difficult to be certain of the origin of the strain in any particular grove. The Duncan was one of the earliest of these, and this name is widely used today for budded seedy grapefruit, and while it was evidently a distinct variety in the beginning, its distinction has been very largely lost through the application of the name to many other strains. Other varieties which at one time were extensively planted are the Walters, Silver Cluster (Hall), McCarty, and Excelsior, but the differences between these varieties were insufficient to make classification easy, and the names used by the owners

to classify the varieties in their groves are not always in strict accordance with the original descriptions. For that reason, there is more and more of a tendency to classify seedy grapefruit as "Florida common" or seedy grapefruit and to omit the use of a varital name because classification of the fruit after it is picked is impossible under present circumstances. The name Duncan is used by many packing houses to cover all seedy grapefruit and about the only seedy grapefruit that has any separation as a distinct variety at the present time is the McCarty , but even here the name is used to cover other strains besides the original one. For that reason, no attempt will be made here to separate the various seedy varieties which usually contain from 30 to 60 seeds, are usually oblate in shape, though the shape varies with fertilization and cultivation conditions. The tendency to bear fruit in clusters, which has been used to classify fruit of certain varieties, is known to be controlled to a considerable extent by nutrition as the same strain will bear mostly clusters under one type of fertilization and mostly separate fruit under another type. The individual varieties which are different from these seedy varieties are described below:

MARSH OR MARSH'S SEEDLESS. This variety was introduced by C. M. Marsh, Lakeland, Florida, in 1895 or 1896,

from a seedling tree growing in Lakeland, Florida. It is nearly seedless, usually having only 2 to 6 seed; fruit is usually oblate and pronouncedly flattened at the ends; pith in the center of the fruit slightly open. Trees are very vigorous growers and heavy producers, resistant to cold and drouth and less susceptible to variations in fertilization and spraying than most varieties of the citrus in Florida. The chief advantage of the fruit on the market is its seedlessness but it characteristically contains less sugar and acid than seedy varieties. It is widely planted and is favored on the market because of its seedlessness, though it is not so satisfactory for canning because of the low sugar and acid content of the juice and the tendency of the segments to fall apart when used for sectionizing. It was originally introduced as a late fruit but is now sold extensively even in early season, and in recent years there has been more and more of a tendency for it to be shipped to the fresh fruit market and for the seedy varieties to be used in the canneries.

THOMPSON OR PINK MARSH. Two strains of Marsh in which the flesh is pink instead of the characteristic light yellow were discovered many years ago by W. B. Thompson in Florida in 1913 and by L. V. W. Brown in California about 1918. Both of these strains are typical fruit except for

the pinkness of the flesh. The Thompson strain, commonly known as Pink Marsh Seedless, was extensively planted in Florida at one time but many of the original groves now have been topworked to the ordinary varieties because the pink color does not show through the peel.

Tangerines

DANCY TANGERINE. This is the principal commercial variety of this group in Florida and has been widely planted throughout the state. The fruit is oblate in shape, usually about 2½ to 3 inches in lateral diameter, deep orange-red to red in color. It has a nipoled base, 11 to 14 sections and usually about 14 seeds, although the seeds may vary widely in number. The skin is very smooth and loose from the pulp, and as the fruit gets riper the pulp sometimes becomes entirely separated from the peel. The pulp is very tender and the flavor rich, with a very definite aroma, some hat spicy. The tree is round-headed, with somewhat willowly branches so that under heavy cropping it sags down badly, and usually heavy crops may result in a great deal of splitting in the crotches. Generally, it is a very heavy bearer with a tendency to produce too many small fruit. This variety is commonly known as the tangerine rather than the mandarin.

There are a large number of [illegible] varieties, including the Mexico, Persuco, Clementine, and Cleopatra, the latter having been used mainly as root stock.

Limes and Lemons

At one time there was considerable production of lemons in Florida, but due to climatic and [illegible] conditions, the growing of lemons has diminished greatly for a few trees in dooryards, while the production of limes has increased because they are better adapted to the climatic and the soil conditions existing in Florida.

Tahiti or Persian. This is a large oval lime, commonly three inches long, shaped much like a lemon, with a very smooth skin, green while, and almost clear of color. The juice is very acid and of excellent flavor.

CHAPTER III

THE PACKING HOUSE

The citrus fruit packing house is based on the same principle as any other food-packing house, except that its processes are many and must be carried out with well-planned efficiency. The packing house is run by a manager, who in turn has a field foreman, who is intimately related in the purchasing a crop of fruit. After the manager, or owner of the packing house has contracted to buy a crop, then the manager gets the machinery of picking, packing, and shipping the fruit off to the auction, or buyer started. The fruit is usually tested for maturity standards (see Appendix I, p. 98) to make sure that the internal quality will meet U. S. Department of Agriculture regulations regarding the marketing of citrus fruit. These laws regulate the shipping of fruit as to percentage of juice, a minimum content of solids in the juice, and the fruit must exceed a specified ratio of solids to acids.

The manager or field foreman usually collects samples of a prospective crop and brings them to the packing house for the test. However, the testing equipment may be taken out in the field. Fruit is usually bought "on the tree basis".

Picking is usually done by packing house crews, however, many large growers maintain their own picking crews. When the fruit reaches the packing house, a test on maturity is made by a Federal fruit inspector, who either accepts or rejects the crop according to the specific test made by him.

The cycle of processing that the fruit goes through when it enters the packing house, can best be seen from Figure 1, on page 107.

When the fruit has completed its cycle through the packing house, and comes out, it is either in nailed or wired bound boxes, or in bags. It is then loaded in refrigerated or ventilated freight cars, depending on the weather. In cold weather pre-cooling and refrigeration is not necessary, but in hot weather it is almost essential. The railroad companies take on the responsibility of re-icing the cars at regular icing stations enroute. Some fruit is shipped by truck in large refrigerated or ventilated trailers. The fruit usually is shipped either direct to buyers, or the auction markets in the big cities in the North.

PREPARATION OF FRESH CITRUS FRUIT FOR MARKET

Years ago, in the cracker barrel era, no special care was taken in presenting merchandise to the consumer.

Today, however, consumer reaction makes it necessary for industry to make commodities not only more sanitary, but also more attractive. This is evident in the vastly improved packages, attractive container designs, appealing color combinations, beautifully lithographed labels, clear transparent wrappers, and so on, to which we have become more or less accustomed. This same progress has extended more and more to the citrus industry as well. The outer peel, to the consumer, is in reality the package of the citrus fruit, and it must be made clean, as well as attractive. This is the work of our citrus packing houses, and the steps involved are, as follows:

1. COLORING ROOM

Grapefruit and tangerines, as well as oranges, do not always possess the high degree of color which the consumer expects. At certain times during the season, depending upon weather conditions the peel of all these fruits shows various degrees of green coloration. At such times the fruit, immediately after picking, is placed in large coloring or blanching rooms from 24 to 72 hours. The atmosphere of these rooms is held at a temperature of 80° to 90°F. with a relative humidity of about 80 to 85 per cent. An amount of ethylene gas is added to this atmosphere to correspond to one part in 5,000. This treatment has the

effect, apparently, of bleaching the green chlorophyl to a colorless compound, permitting the underlying pale lemon yellow color to show. By way of further explanation, chlorophyl is the very complex organic compound which is responsible for the green color of all vegetation. Though it is one of the most common and plentiful organic compounds, yet we do not know its exact chemical structure (Rockefeller Foundation project). We know that it contains carbon, hydrogen, nitrogen, oxygen, and magnesium in definite proportions, yet we do not know exactly how the atoms of these five are linked with one another. Moreover, there appear to be several forms of chlorophyl. Strangely enough, while chemists have been able to prepare synthetically from their various elements most compounds, yet they have not been able to synthesize in this manner sugar or other carbohydrate materials. Plant life, however, due to the presence of chlorophyl is able to produce in the presence of sunlight sugars, starch, gums, etc., from carbon dioxide and water. General Motors' very famous Dr.C. F. Kettering Foundation at Antioch College in Ohio is for the sole purpose of studying chlorophyl and the manner in which it functions. He believes that a thorough knowledge of this will teach us how nature is successful in storing such vast amounts of energy in the form of wood, peat, coal, gas, and oil.

Referring again to citrus fruits, the ethylene gas, in the quantities used, is not at all harmful to fruit. The blanching effect will actually take place in the absence of this gas, but the reaction is very considerably speeded up due to its catalytic or hastening effect.

Relatively dry and cool weather causes citrus trees to become more or less dormant as far as growth is concerned, with the result that additional amounts of chlorophyl are not formed in the peel of the fruit still on the trees. Actually, the green coloration disappears from the fruit and they assume the deeper yellow, orange or red coloration which the consumer expects. Such fruit is not given the blanching treatment.

2. WASHING:

The second step is that of washing. During the growing season, the fruit and the trees are exposed to a number of different sprays, the purpose of which is to eliminate destructive insects, fungus, and other parasites. Spray residue, fertilizer dust, and soil dust accumulate and deposit on the fruit, causing it to have a very dirty and unattractive appearance.

The washing process consists of soaking the fruit for one or two minutes in water containing a small amount of water softening agent, and a small amount of soap.

Following this, they are passed across a series of brushes on which is dripped a diluted soap solution. In the end section of the brush washer, clean fresh water is thoroughly sprayed to remove residual loosened dirt and soap.

3. COLOR ADDED:

At this point, oranges which are pale in color are treated with the color-added recess. Grapefruit, tangerines, and highly-colored oranges are bypassed around this unit. The application of color-added is in certain respects relatively simple. It is not done, as has been stated on occasion in Northern markets, by injection with a hypodermic needle. The method of application consists of flooding the fruit with a relatively dilute bath of dye in water. In some houses the fruit is submerged in the bath. The treatment is applied for a period of three to six minutes at a temperature of 115 to 125 degrees F. The time and temperature is varied according to the receptibility of the color of the fruit. Some lots of fruit are easier to color than others. The temperature is no greater than that of a hot shower bath. The color application is practically a surface treatment since it actually penetrates no more than a few thousandths of an inch, if that much. This slight penetration is necessary in order that the color will be fixed. Several commercial dyes are used.

4. MOLD AND DECAY INHIBITING TREATMENT:

The next step in the operation following washing consists of treating the fruit with a very dilute solution of one of several chemical compounds, either sodiumphenylphenate or borax. These substances have a powerful antiseptic action on blue and green mold, and other decay producing organisms. According to many tests the sodium phenate is one of the most effective agents known. The treatment is applied either by flooding the solution over the fruit, or by submerging them in a bath of the solution. The treatment is applied over a period of from three to six minutes, at a temperature of 100° F. In the case of color added oranges, the inhibiting agent is generally incorporated in the color bath. Neither of these agents under the conditions of their use have any deleterious effect on the fruit itself. This is controlled by the Food and Drug Law.

5. APPLICATION OF PRESERVATIVE WAXY COATING:

The next step, namely that of providing the fruit with a preservative waxy coating, is an extremely important one. Several different methods are employed, depending upon the desires of the individual houses. These consist of the following:

(a) Flavorseal Spray Wax Method

This method consists of spraying the fruit, at room temperature, with a solution of waxy materials in a harmless, quick-drying solvent. In this method, the fruit passes through an applicator at a definite speed, such that it receives exactly the right amount of wax. Specially constructed rollers are provided to rotate the fruit so that all surfaces are exposed to the spray. The spray is so fine that less than 0.007 of a fluid ounce is required per orange. While this method is employed, the fruit is dried and then polished on roller horsehair brushes before being waxed.

(b) Hot Melted Wax Method

In this method, the fruit is dried following washing, and is then treated while rotating on horsehair brushes in a closed applicator with a spray of melted waxy material. The inside of the machine as well as the wax is kept at a temperature slightly above the melting point of the wax. Following this the fruit progresses through the house on a roller conveyor of sufficient distance to permit the wax coating to set, following which it is polished on rotary horsehair brushes.

(c) Water Wax Emulsion Method

Where this method is used the fruit is dipped or

sprayed into a relatively dilute water wax emulsion. The surplus solution drains off while the fruit is conveyed on a roller or mesh conveyor, and is then dried under lens, with warm air, and then finally polished.

(d) Slab or Pan Wax Method

Where this method is employed the fruit is dried and then passed over rotary horsehair brushes under and against several of which bars or narrow slabs of wax are held. Following this the fruit is polished.

6. GRADING:

After the preservative waxy coating is provided, the fruit is carried on a roller conveyor over which are suspended a series of lights. It is at this point that skilled workers separate the fruit into the various grades defined and specified by the U. S. Department of Agriculture.

7. SIZING:

The next step is that of sizing. This is done mechanically and each separate size drops into individual bins. Oranges are separated into as many as nine different sizes, and grapefruit eight.

8. PACKING:

The final step is that of manually packing the fruit into the box and mechanically fastening the lid. In warm

weather the packed fruit is frequently pre-cooled, and then shipped in refrigerated cars. Some shippers do not pre-cool. During cold weather fruit is shipped in open-vent cars. Packing houses range in size from a capacity of one to twenty-five cars per day.

PURPOSE OF WAXING:

In outlining the various steps in packing house procedure, I merely mentioned the various methods employed to provide fruit with a waxy coating. This coating is extremely beneficial in four ways:

1. It gives the fruit a bright, attractive appearance.
2. It greatly minimizes shrinkage due to loss of moisture, and holds it in a plump, firm condition.
3. It preserves the fresh flavor and good eating qualities.
4. It minimizes subsequent infection of the fruit by spoilage organisms.

CHAPTER IV

MARKETING CIRCLE

Sales of Fruit by Shippers

There are two principal methods employed by shippers in selling fruit today. They are F. O. B. shipping point sales, and auction sales. Most shippers sell most of their fruit through the auctions in the large terminal markets in the East, while others sell little or none by this method. The latter group prefers to sell on f. o. b. basis. The principal auction markets are located in Baltimore, Philadelphia, New York, Boston, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago and St. Louis. The shippers who sell at the auctions have representatives at the auction ready to unload. The fruit is inspected with the auction company for sale. It is the responsibility of the representatives to attend the auction sale, and otherwise represent the interests of the shipper. However, some of the larger shippers maintain their own salaried employees at the auction houses to handle their auction and other sales. The majority of shippers prefer the auction method of selling to brokers and auction receivers. Most of the F.O.B. shipping point sales are handled through brokers or salaried employees of the shippers.

There are many factors that enter into, and

sight draft, commission, consignment, and delivered sales. The former involves shipping fruit to commission merchants and jobbers to sell the fruit for the account of the shipper on a specified commission or fee basis. In the latter type of sale the shipper offers the fruit to buyers at a price f.o.b. the point of delivery and assumes all freight charges and transportation risks.

Sales of Fruit by the Growers

There are generally three principal methods used by growers in selling their fruit. They are:

1. Sales through cooperative marketing associations of growers.
2. On tree sales to shippers who are known as "cash buyers".
3. Consignment sales.

There are a number of cooperative marketing organizations throughout the state, that handle all of the functions from grower to shipper. Most of the balance of the fruit is sold by growers to shippers and canners at a special price per box or per ton on tree. Under this type of sale the buyer is responsible for harvesting and hauling the fruit to the packing house. In some instances, growers enter into contracts with shippers to handle their fruit on a consignment basis. Under this arrangement the shipper

sells the fruit for the grower's account and returns all the proceeds to the grower after deducting handling charges specified in the contract. Grove caretakers often handle the fruit with picking crews and deliver the fruit into the packing house for the growers.

Fruit is usually transported by truck, rail, or by boat. According to the Citrus Inspection Bureau's statistics for the 1945-1946 season the following are the number of boxes shipped:

Grapefruit boxes 8,611,014
Oranges - boxes 27,836,957
Tangerines - boxes 3,228,711
TOTAL boxes 39,676,582

Foreign Trade

Trade with other nations in citrus fruit has dropped off considerably from the pre-war level. Of course, one of the biggest reasons for this lack of international trade is due to the dollar shortage in European countries.

California is still able to compete with Florida on the continent. One reason for this is that the European wants more for his money than any other buyer in the world. The small fruit of California is most advantageous for selling in Europe, due to its small size. The merchant sells by the Kilo, and, therefore, likes to give the customer more in numbers for his money. Quality must also

to consumers in the foreign market.

[illegible] of the main problems of flying citrus fruits [illegible] is the foreign market is that old problem of decay, while in transit. At [illegible] time, there is little chance of getting refrigerator service [illegible] by the local steamship companies, and until this time, the European market will not accept any Florida fruit.

Selling in Europe

The international trade between countries always involves a monetary exchange of currency which brings in international banking. The big problem in the citrus industry on foreign trade is that they are selling in [illegible], and the European buyer will not purchase [illegible] in the port of f.o.b. basis, thus assuming all the risks of transportation, and decay while enroute. The established methods of selling on export are, as follows:

1. F. a. p. purchase at the packing house in Florida.
2. C. a. f. purchase at their delivery alongside the steamship.
3. C. i. f. fruit delivered at the docks in a European port.

The financial arrangement builds itself around one of these methods of sale, and is either paid for at a sight draft, irrevocable letter of credit from a European

firm in an American bank, or sold to a European buyer on consignment.

It is, of course, hoped that the new Marshall Plan will be of assistance to the Florida shipper. The Economic Cooperative Administration is trying to stimulate foreign trade under the Marshall Plan. Fresh fruit is one of the priority items on the food list, and the Florida shipper should do his best to get into this business and assist in European recovery, and subsequent world peace.

MARKETING DISEASES OF CITRUS FRUITS

Market diseases of fruits and vegetables are those that develop during the process of marketing. This process should be understood to include the harvesting, grading, and packing of the crop, its transportation to market, its storage at shipping point or at the market, and the various handling operations required to move it from the wholesale dealer to the retail store and the ultimate consumer. During any of these operations the product may be subjected to conditions that impair its appearance and food value and render it liable to attack by decay-producing organisms.

The fruits discussed in this publication, like all other fruits and vegetables, are susceptible to invasion by bacteria and fungi at bruises and skin breaks. Hence, it is of prime importance that they be handled as carefully

as possible at all times. Clipper cuts, fingernail scratches, injuries caused by packing-house machinery, packing bruises, damage caused by rough handling in transit and on the market are all sources of danger, especially if the places where the fruit is packed, or stored, or offered for sale are not kept free of rotting fruit and other infectious material. These, as well as insect injuries, must all be considered by anyone attempting to judge the storage or shipping quality of the fruit or its ability to hold up well until it is consumed.

Temperature and humidity have a direct effect on the development of decay in fruits. They should have the critical attention of those who wish to ship or store fruits and those who attempt to determine why a given lot, at any stage in the marketing process, shows decay or other deterioration. Too low a temperature may freeze the fruit, or it may cause only chilling injury; subtropical fruits are particularly susceptible to such injury. Too high temperature favors decay and may cause undesirable color changes. High humidity favors growth of fungi, and low humidity causes loss in weight and possible shriveling, especially if combined with high temperature. For all of these reasons, the management of storage rooms for citrus and other subtropical fruits and the choice of conditions under which to ship them to market, whether under refrigeration

or ventilation, are not likely to give the best results unless based on an intelligent use of all available information concerning the market diseases of those fruits.

CHAPTER V

GROWING CITRUS

Cultivation

The general cultivation practices in citrus groves in Florida consists of disking the cover crop in the fall during the summer period when there is plenty of rainfall and no cold hazard. During the fall, after the rainy season, the cover crop is either disked into the top soil or plowed under. Bearing citrus trees are fertilized three times a year--spring, summer and fall. For pest control sprays with high pressure are used with a long dise in the spray gun which turns the leaves so they will be wet on both sides. Speed sprayers are used most generally in the large groves. Even airplanes are being utilized in the spray program. It is better in pest control to prevent, rather than try to control after infestation of insects harmful to the fruit and tree. Irrigation during critical periods is necessary in most groves to prevent wilting of the leaves from lack of moisture. Irrigation keeps the tree in a state of high metabolism, in that the sap is up in the limbs and leaves. If this condition exists during a freeze, the trees that have been irrigated recently may be hit pretty hard. It is not intended to give a complete dissertation in

this text on cultivation of citrus, as this is quite a technical field with many ramifications. For the benefit of those interested the following list comprises a few of the essentials in the proper care of a bearing grove:

1. Fertilization - three times a year.
2. Cultivation - harrowing discing, hoeing.
3. PH control - test twice a year.
4. Pruning - removal of deadwood, periodically.
5. Cold protection - grove heater and proper air drainage.
6. Pest control - spray program periodically.
7. Irrigation - when needed.
8. Equipment - sprayers, fertilizers, tractor, etc.
9. Labor.

Canning Citrus

The earliest method of processing citrus was that of canning, the first successful attempts being made in 1920 after more than seven years of experimentation. Within four years, Florida citrus, vacuum packed in tins, was being shipped from the State in carload lots.

Whole crops are now being grown for canning only. For grapefruit juice the seeded grapefruit is shown preference due to the higher solids content of its juice. However, a good quantity of seedless is also utilized. All

orange varieties are utilized for canning purposes, but the mid-season Valencia varieties have preference.

Processing

Oranges and grapefruit for canning purposes arrive at the canning plant usually by truck in bulk quantities. They are then transferred to elevated, ventilated storage bins capable of holding large quantities of fruit. Going into the canning plant proper, the fruit is washed, graded and thoroughly inspected. Any unwholesome fruit is removed in the grading. A citrus fruit inspector in each canning plant keeps rigid check on the quality of the fruit.

After washing, grading and inspection the fruit is automatically sliced and extracted. The juice is then screened to remove seeds and pieces of pulp. Following screening, the juice is de-aerated under vacuum and pasteurized. The de-aeration step insures the maximum preservation of flavor and vitamin content. After pasteurization the juice is automatically poured into sterile cans and the canned juice is quickly cooled to room temperature and stored. Sweetened juice is obtained by adding quantities of sugar or sugar syrup to the juice prior to canning. Blended juice is a mixture of grapefruit and orange juice which usually contains from 50 to 60 per cent grapefruit and 40 to 50 percent orange juice.

In addition to juices, citrus segments are also canned. Oranges and grapefruit used for sections are treated somewhat differently than fruit used for juice. After washing and grading, the fruit is immersed in hot water for several minutes. This treatment plumps and loosens the skin without heating the inside of the fruit. The fruit is peeled by hand and placed in baskets. The baskets of peeled fruit are then immersed in an alkaline bath which removes the outer membrane covering of the juice sacs. The alkali is washed off by sprays of fresh water and the sections are removed by hand with a triangular-bladed knife. The utmost care is taken not to break the sections as the operator is paid on the piece basis; the sections are finally packed in cans to which sugar syrup has already been added. The cans are finally sealed, sterilized, cooled and stored away.

"Citrus salad consists of grapefruit and orange sections packed in the same can, and is not only very tasty but also very pleasing to the eye."

Research has proved that 97% of the ascorbic acid (vitamin C present in fresh unsweetened grapefruit juice is) retained in the canning process. This percentage decreases to 80%, however, after storage for more than six months at room temperatures.

UTILIZATION of CITRUS PROCESSING WASTES

The manufacture of by-products in an industry is the result of any one or a combination of urges:

1. Opportunity to augment income.

1. Economic necessity.
2. Need for methods of disposing of a public health nuisance.
4. Scientific research for substitutes for scarce materials or for the development of cheaper or improved products.

Through the economic advantage gained by maximum utilization of an agricultural crop, both the processor and the grower are materially benefited. The processing of citrus fruits, i. e., canning is a particularly apt example as some 60% of the fruit is unused in canning and from this waste material has developed an important phase of the citrus industry in Florida.

Citrus By-Products

"Canning residue include peel, pulp, seeds, cores and interlocular membranes. Liquid effluents result from processing and cleaning operation. From these residues and effluents may be obtained a variety of products, including fixed and volatile oils, waxes, resins, pectin products, cellulose, glucosides, sugars, feed, fertilizers, syrups, yeasts, alcohol, fuels, plastics, citric and lactic acids, and so forth." (See figures 1, 7, 8, pp. 107-109.)

Citrus Pulp Feeds

From the point of view of quantity, the most important use of the residue from the cannery is in the manufacture of cattle, poultry, and dog feeds.

The feed is manufactured from the refuse peel, pulp and seeds which are first ground or shredded and to which

is added less than 1% of lime. The mass is usually pressed to remove a part of the moisture, then kiln dried. Final moisture content is from 5% to 10%.

Citrus pulp feed is a fine conditioning feed, resembling beet pulp, for both dairy and beef cattle. Reid[10] gives the composition of the feed as approximating:

Protein, fat and ash, each . . . . . 4 to 7 per cent

Crude fiber. . . . . .10 to 17 " "

Pectic compounds . . . . . .15 to 19 " "

Recent experimentation confirms the possibility of increasing the value of the feed by augmenting the nitrogen content. As a consequence, less feed of other types, high in protein, are necessary.

This is particularly beneficial to the cattle industry in Florida, far removed from the larger producing areas of other fields.

Detailed studies of the economic feasibility of pressing, or drying without pressing, and other phases of the manufacturing processes have been made under actual production conditions.

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[10] Reid, J. L., Florida Citrus Canners Cooperative, Lake Wales, Florida, Drying Citrus Cannery Wastes and Disposing of Effluents, Food Industries, December 1945.

Citrus Syrup

The liquor obtained from pressing the bulk citrus residue (some 1800 gallons for every ton of dry feed) is used principally in the manufacture of "final citrus syrup".

This syrup resembles cane molasses "in appearance and sugar content. It is valued for animal feeding because of supplemental food values extracted from citrus peel. It is also sought as a source for fruit spirits for use in cordials, brandies and fortified wines."

To manufacture the syrup, the press liquor is screened, protected against fermentation and concentrated through evaporation.

Feed Yeast and Industrial Alcohol

> "The sugar content of the press juice might be fermented with suitable organisms to yield industrial alcohol, feed yeasts, or lactic or butyric acid for use in plastic and tanning industries."...Nolte[11]

> The data indicate that about 25 gallons of press juice were required to yield one gallon of 190 proof alcohol. As a by-product about 18.5 ounces of dry yeast, which could be used as a stock feed would be obtained per gallon of alcohol produced. The problem of the economic disposal of the spent wort, although not so difficult as that of the original press juice would be of some moment."...Veldhuis[12]

> "When press liquor is used for the production of alcohol, less than 75% of the energy originally in

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[11] Nolte, A. J., Von Loesecke, Harry W., Pulley, George N., Bureau of Agriculture Chemistry and Engineering, U.S. Dept. of Agriculture, Winter Haven, Florida, Paper, AIC-88; Feed Yeast and Industrial Alcohol from Citrus Waste Press Liq.

[12] Veldhuis, M. K., Citrus Products Station, Winter Haven, Investigation on Citrus Fruit Products, Proceedings of The Florida State Horticultural Society, 1944.

the sugar is lost. More than 75% of it is still present in the alcohol. This is why alcohol can be used as a fuel. The total amount of yeast that grows in a mash is dependent upon the amount of energy which it is able to obtain from the nutrients in the mash. Excessive yeast growth is of no special importance in the production of alcohol, but a good price an be obtained for yeast itself because it is a high-protein feed. Therefore, considerable study is being given by the government and by industry to the problem of producing yeast for supplementing citrus-pulp feed, as another method for providing a balanced ration for cattle."...Nolte

Pectin

One of the more recent citrus by-products manufactured in Florida is pectin and is the result of the expansion of the national and international jam and jelly industry.

A method has been developed for the production of a crude dried citrus pectin from waste grapefruit peel. The process is simple, inexpensive, and requires little specialized equipment. The product is free of objectional flavors, is stable, and can be used in the manufacture of almost any food product that requires added pectin.

The process consists essentially of separating the seeds by means of moving a screen, grinding or chopping the peel into small pieces, treating with hot water to inactivate enzymes and extract soluble material, extracting twice with cold water to remove more-soluble material, pressing to remove as much water possible, packaging in moisture

proof containers. When aluminum sulfate was added to the last cold bleaching water, it was found that the water could be pressed out more easily and efficiently. The dried product is equivalent to about a 50-grade pectin.

The crude pectin is sold in dry form and a pectin solution is prepared from it when needed. This is done by boiling in a dilute solution of acid and filtering to remove fibrous material. The solution can be used directly in the preparation of jams, jellies, marmalades and other food products.

For many years, pectin has been used in small quantities for medical and pharmaceutical purposes. This pectin is used for treatment of diarrhea, bacillary dysenteries, traumatic shock, as a substitute for human plasma and in medicinal pastes and emulsions.

> "Pectin which is for use in pharmaceutical and medical applications must be of greater purity than is ordinarily available for commercial purposes. The bulk of the pectin now being used for medicinal purposes is prepared by process which makes the use of the fact that certain ions with large positive charges precipitate the negatively-charged pectin. The colloidally precipitated mass is washed repeatedly with acidified alcohol, rinsed thoroughly with a pure alcohol and finally vacuum dried and ground."

Citrus Peel Oil

Oil from the peel of the orange, grapefruit, tangerine, and lime is used extensively as a food, liquer and cordial flavoring and in the manufacture of perfumes.

"The peel is first ground and the resulting mass is

proof containers. Once climate control [illegible]
least, and planning out [illegible]
could be [illegible]
cried prevent [illegible]
could work [illegible]
solution is [illegible]
by making [illegible]
roomy library [illegible]
in the [illegible]
[illegible]

For many years, [illegible]
tions to [illegible]
portion [illegible]
Specifically, [illegible]
plans for [illegible]

Proctin [illegible]
cal applications must be [illegible]
sodium-ly available [illegible]
of the protein by being [illegible]
prepared by [illegible]
that certain [illegible]
late the [illegible]
precipitated [illegible]
alcohol. [illegible]
finally vacuum [illegible]

Citrus Pest Ill

Oil from [illegible]
line, and [illegible]
cordial [illegible]

The pest is first [illegible]

firmly pressed. The oil is then separated from the ensuing liquid by means of a super-centrifuge. In recent years over a quarter of a million pounds of these oils have been produced annually."

Citrus Supply

Florida is the world's largest citrus producing area, with two-thirds of the grapefruit yield and one-third of the orange yield utilized in processing, residue for the manufacture of by-products is readily available in quantity.

FLORIDA CITRUS PRODUCTION

1944-45 Season	1945-46 Season
62,000,000 boxes	88,000,000 boxes

CONCLUSION

1. A variety of by-products can be made from the residues of citrus processing.
2. The manufacture of these by-products is economically feasible.
3. Florida is the logical location for the manufacture of such products.

Remarks: The interested reader is urged to give further examination of the papers referred to in the bibliography for full details relative to the chemistry, mechanics and economics involved in the production of the citrus by-products treated herein.

CHAPTER VI

GOVERNMENT CONTROL

Citrus Inspection Bureau (Federal)

The Citrus Inspection Bureau of the Florida Department of Agriculture with headquarters in Winter Haven, Florida, is the division through which the Department serves the citrus industry in a measure of protection to the industry and the consuming public.

Florida's Commission of Agriculture is charged with the enforcement of the Citrus Fruit Laws and the regulations of the Florida Citrus Commission. The work of the Bureau deals chiefly with the application and enforcement of the following Laws: Bond and License, Citrus Maturity Laws, Color Added, Frozen Fruit, Arsenical Spray, Processing Materials, Fruit for Canning, and the Grade Standardization under the Citrus Commission Law. The Bond and License Law requires that every citrus fruit dealer obtain a license from the Department upon approval of their application by the Florida Citrus Commission, and post a bond in the proper amount with the Department before the license is granted. This Act guarantees the producer the price set is promised for the fruit and tends to eliminate the irresponsible operator. It is around this fact that the Bureau is able to enforce compliance with the several other Citrus Laws.

The Maturity, Standardization, and Color-Added Acts deal chiefly with the inspection and certification of the quality of the fruit, both internal and external.

Inspection of the fruit and certification of same is made only at registered processing plants, packing houses, and canning plants within the state, while it is being prepared for fresh fruit shipments or for processing. It is required that each lot of fruit meet the requirements of the Maturity Laws and the Grade Standards adopted by the Florida Citrus Commission. All fruit processed for canning must be round and mature. An inspector is maintained at each packing house and canning plant within the state during its active operation, the larger houses requiring the services of two or three men.

The State Certificates cover grade, maturity, and color-added requirements, regulations, and other necessary information for tabulation at the winter haven office. The certificates are issued in quadruplicate copies. The fourth copy is retained by the inspector, the third copy delivered to the shipper, the second copy is required filed with the transportation company upon acceptance of shipment and it is this copy which bears the proper denomination of cancelled revenue stamps in payment of inspection fees and advertising assessments. The first, or original, copy of the certificate (accompanied by a complete shipper's manifest,

after clearing the typing office where a Federal-State certificate, as to grade, is typed) is delivered to the statistical department of the Bureau for auditing. From the certificate and manifest the following information is punched out for tabulation: Certificate No., Inspector's No., date, shipper, County, District, how shipped, kind--grade and variety of fruit--, type of container or bulk, sizes, whether or not color added, and various other detail information. Weekly tabulations of shipments by grade and size are furnished the Growers, Administrative Committee, in Lakeland, Florida, for their use in administering the Federal Marketing Agreement under which the citrus industry is now operating.

The field service of the Bureau operates through fifteen districts sub-divided into four regions. Each district is headed by a supervisor under whom each inspector works directly in carrying out the various duties he is assigned to perform, such as maintaining compliance with all Commission regulations, inspecting, and certifying fruit as to grade and maturity. The four regional men serve as assistants to both State and Federal representatives at Winter Haven, in directing every phase of field work the Bureau performs. It is through the district and regional men that the Bureau maintains its direct contact with the field force and with the shippers or pro-

cessing operators. The field force of inspectors varies in direct ratio to tonnage moving, numbering from 200 at peak season to 25 to 30 in August.

The Department of Agriculture maintains chemical laboratories at Bureau headquarters in Winter Haven where processing materials such as color-add dyes, wax, oils, soaps, etc., used in processing citrus fruits are analyzed and authorization for use granted after it has been proven that they contain no foreign material which may damage the fruit when used. The regular work enforcement of the law prohibiting the use of arsenical sprays is handled through these laboratories.

At the Bureau's headquarters in Winter Haven there is a tabulation of wires received from each of the several districts giving a daily citrus shipping report. This report is released to the press at 10:00 a.m. each day and may be obtained by any operator by wire or telephone upon request. It covers the previous day's operation in total volume of shipments, fruit packed, unprocessed, and the estimated picking, by kinds of fruit.

The Department operates eight (8) Road Check Stations at strategic points on the highways leading out of Florida, throughout the shipping season in order that all truck shipments of citrus fruits be intercepted for clearance papers. Truck basis reports are submitted by the Citrus

Inspection [illegible] and copies sent to the Federal-State Marketing Service, Lakeland, Florida, for use in listing interstate destinations.

The total operating costs of the Bureau and service are paid by the citrus industry through inspection fees as set forth in the various bases, according to the services rendered in the inspection of fresh fruits or fruits for processing.

The work of the Citrus Inspection Bureau may be best summed up as a service to the citrus growers of the State which protects the industry on two vital points--(1) it requires all citrus fruit dealers to be bonded and licensed only to meet their commitments; (2) it makes certain that the fruit does not leave the state if it is processed within the state unless and until it meets all requirements under the Citrus Laws and the Florida Citrus Commission regulations.

State Marketing Bureau

The State Marketing Bureau furnishes federal-state inspection for car lot shipments. The grade and condition of shipments as certified by inspectors are used in court in case of disputes between shippers and consignees, or buyers or transportation companies as to grade and condition at

point of shipment.

The State Marketing Commission also furnishes citrus market news to the public, to the daily press and by radio.

Grade and Size Marketing Agreement

Interstate shipment of Florida oranges, grapefruit and tangerines are controlled by a Federal Marketing Agreement and order. Administering the Agreement and order are two committees, the Shippers Advisory Committee and the Growers Administrative Committee, the members of which are selected by the Secretary of Agriculture from nominations made by the industry.

Guided by market conditions, the Secretary of Agriculture upon recommendation of the committees, restricts interstate shipment to the most desirable grades and sizes. The Agreement and Order has been in operation since February 1, 1933.

Florida Citrus Commission

The Florida Citrus Commission consists of eleven representative growers and shippers of citrus fruits. Its members are appointed by the Governor.

THE DUTIES OF THE CITRUS COMMISSION:

Promulgation of rules and regulations for the

handling of citrus fruits. The principal regulations relate to the following activities:

a. Maturity tests for citrus.

b. Grade standards for citrus.

c. Forms and instruction for issuance of certificates of inspection.

d. Approval of licenses of citrus dealers and notice of operation.

e. Payment of inspection fees.

f. Affixing of citrus stamps (inspection and advertising).

g. Artificial coloring of fruits.

h. Coloring room practices.

i. Adoption and use of containers.

j. Registration and use of labels.

k. Issuance of permits to truckers and for special shipments.

l. Test for fruit damaged by freeze.

m. Tests for prevention of canning of unwholesome fruit.

n. Method of making returns for advertising assessments.

o. Proper filling of containers.

These regulations are promulgated by the Commission and enforced by the State Department of Agriculture.

State Plant Board

The State Plant Board is charged with the responsibility of protecting Florida's agriculture and horticultural interest from the introduction, establishment and dissemination of dangerous plant pests and the control or eradication of such major pests as may gain entrance, when such procedure is deemed necessary or practical.

Source of authority under which the Plant Board operates is the Florida Plant Act of 1927, which replaced the Plant Act of 1915. Board members are appointed by the Governor, and serve for four years without compensation.

Florida is an agricultural state. Its geographical location is such that it is more exposed than any other state to invasion by plant pests, especially from foreign countries. The great increase in transportation facilities makes it possible for the introduction of serious plant pests. Only by maintaining well-organized nursery, grove, and quarantine inspection forces can the State's plant life be protected against attacks by plant pests.

The Plant Commission is the chief executive officer of the State Plant Board, and has general direction of field activities. The Major departmental activities are:

Nursery Inspection, Grove Inspection, Quarantine Inspection, Apiary Inspection, and Entomology.

CHAPTER VII

CITRUS FRUIT AND HEALTH

Nutrition Story of Citrus

Vitamins are nature's ammunition in the battle against nutritional deficiencies affecting the health of millions of Americans today. Oranges, grapefruit, and tangerines are rich in vitamin C. Daily intake of this important vitamin is necessary to vigorous health, since it is rapidly utilized in the body and is not stored from day to day.

Subclinical vitamin C deficiency may result in poor bone building, certain undesirable gum conditions, and is associated with low resistance to infections, and retarded growth. A normal supply is necessary to prevent scurvy, is essential for proper healing of wounds, and for the development and maintenance of normal bones and teeth, and aids in maintaining a high level of positive health.

Other Vitamins in Citrus Fruits

Citrus fruits also contain vitamins A, B1, B2, P and a new vitamin P, all now recognized as essential to life, health, and for growth. These vitamins play an important role in energizing the body, steadying the nerves, beautifying the skin, and in maintaining general physical well being.

Important Nutritive Factors

All citrus fruits supply valuable carbohydrate in the form of fruit sugars. The natural appetizing tart flavor is due largely to citric acid, which burns in the body to yield energy, leaving an alkaline residue which tends to counteract acidity. The peculiar blending of acids and acid salts, with natural sugars and aromatic compounds, is refreshing and appetizing.

The use of foods containing the necessary vitamins and minerals and possessing the other factors aside from vitamins is the proper way to make sure of an all-around nourishing diet.

Need for "Protective" Foods...for the maintenance of good health, modern nutrition stresses the importance of a diet adequate in every respect. This includes sufficient calories for energy expenditure, suitably apportioned between wholegrain products, vegetables, fats, and protein of good biologic value, and an abundance of the so-called protective foods--eggs, dairy products, leafy vegetables, and citrus fruits.

Treatment of the deficiency states demands such a diet, supplemented when necessary by preparations containing minerals and vitamins in concentrated form. In general, one should emphasize strongly the importance of supplying the vitamins in natural foods. Minot says: "To detect

deficiencies and remedy them piecemeal by supplements of manufactured concentrates will not at present solve the problem. Experience tells us that a mixed diet of natural foodstuffs . . . gives the best results."

The therapeutic value of citrus fruits in deficiency states is traditional: they have been employed in the treatment of scurvy for nearly two centuries. Their nutritional and health-restoring properties are due to their richness in vitamins, their content of citric acid, citrates and easily assimilable sugars, and an appeal to the senses which makes them universally acceptable to young and old, sick and well.

Oranges are an "Excellent" source of Vitamins C, B1, G, and P, (ascorbic acid, thiamin, and riboflavin), and a "Fair" source of Vitamin A. Grapefruit are an "excellent" source of Vitamin C, and contain Vitamin A and the carotenes. (Rated according to the standards of the Council on Foods, American Medical Association.) Citrus fruits supply carbohydrates in the form of dextrose, levulose, and sucrose. Their natural attractive tartness is due largely to citric acid (part free and part as citrates), which burns in the body to yield energy, leaving an alkaline residue which helps to balance the acidity due to metabolic processes and the acid-forming foods.

The following table shows the approximate amounts of

some of these substances in oranges, grapefruit, and tangerines:

	Oranges	Grapefruit	Tangerines
		(per 100 c.c. juice)	
Vitamin C (Ascorbic acid)	50 mgm.	40 mgm.	40 mgm.
Vitamin B1 (Thiamin)	80 micro-grams	84 micrograms	80 micro-grams
Vitamin G (Riboflavin)	Excellent source	Excellent source	Excellent source
Vitamin A (or Carotene)	Present	None	Present
Vitamin P	Present	Present	Present
Carbohydrate (sugars)	11.2 gm.	10.1 gm.	10.6 gm.
Citric Acid	0.9 gm.	1.0 gm.	0.75 gm.
Potential alkalinity	5 cc. N alkali	4.5 cc. N alkali	4.5 cc. N alkali
Food value	50 calories	45 calories	45 calories

Citrus fruits are natural foods which do not have to be "improved" in order to appeal to the senses. Scientific methods of cultivation and modern distribution facilities bring the fresh fruit to the world's markets at surprisingly low cost. Their season is long, concentrating chiefly in winter when many other fresh fruits are not in the market, while canned citrus products of great palatability and high nutritive value are available and used at any time.

Bo[illegible][13] writes: "Their content of vitamin, min-
erals, organic acids, fruit, and the, t[illegible] with
their alkaline reaction in the body, make [illegible] on a
meat v[illegible] in addition to acting as a
well-balanced diet, the principles of which should be
observed [illegible] every to it a diet, but not violated in
any special diet. Their flavor and tartness make them
most acceptable when other foods cannot be taken."

Citrus Products High...Brenneman[14] states that
while the protective dose of orange juice is not precisely
known, a large quantity does no harm, and recommends that
it be administered within the first month of life, one-half
ounce daily, increasing as needed at the child's tole-
rance to the juice of one orange a day. He says that
chemically pure vitamin C differs no [illegible] over
orange juice for oral administration, except in the rare
instance of sensitivity to orange juice, and even then one
is justified in disregarding the rule. The orange juice
may be given undiluted, diluted with water, or added to
the milk formula; mixed with milk it forms the so-called
"acid milk" in which the curds are smaller, softer, and more
easily digestible.

Although orange juice is the preferred anti-scorbutic
for infants, grapefruit juice may be given at times for the

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[13]Bo[illegible]n, [illegible]., Citrus Fruits and Is Cold Tank Play
[illegible] Vital, Modern Feeding, [illegible], 1943.

[14]Brenneman, J., Problems of Childhood, The Stevens,
Maryland, Price, 1937.

sake of variety. Its vitamin content is high, and babies accept its slightly bitter tartness without demur.

Children's Needs...four ounces of citrus juice or its equivalent in citrus fruit is suggested as the daily allowance for small children, the amount being increased with the age of the child up to 8 ounces or more at the age of 12 and thereafter. Much larger quantities may be advantageous; certainly this natural food is to be preferred to the "sodas" and "soft drinks" so enormously consumed today.

Harris[15] says: "It has been proved repeatedly that children show a better performance...when extra supplements are included in their diet, although their previous diets and clinical appearances were considered to be up to the average and therefore mis-named 'normal'."

Aldrich states[16]: "The thoughtful physician of today must see to it that the children he cares for are taught to eat a wide variety of foods as little changed from the natural state as possible. In this way one would expect to supply adequate amounts of the known vitamins, and also the ones which the future investigators will discover tomorrow."

Conclusion

Nutritional deficiencies are common; surveys indicate that fully one-third of the population exists on diets deficient in one or more of the essential factors, especially protein, minerals, and vitamins. Most deficiencies are

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[15] Harris, L. J., The Reality of Partial Deficiencies Lancet 2: 593, 1940.

[16] Aldrich, C. A., The Use of Vitamins in Children's Medical Clinic N. A. 21:65, 1937.

multiple; the diagnosis of an deficiency state suggests careful search for others. Partial or sub-clinical deficiencies, because of their widespread occurrence and their insidious effects on large numbers of people, constitute a serious economic, medical, and public health problem.

Prevention and treatment of these conditions, in general, demand that the national diet include a far greater proportion of the protective foods--eggs, dairy products, leafy green vegetables, and citrus fruits.

The normal requirements for the vitamins are not known exactly, and there are individual variations of need among normal people, hence any figure suggested must include a substantial factor of safety to afford protection against the ordinary vicissitudes of life. The amount of vitamin C necessary to prevent scurvy is about 10 mgm. daily, but the basic requirement should be considered 50 to 60 mgm., and 100 mgm., or more is suggested for optimum nutrition and buoyant health.

Infancy, normal growth, pregnancy and lactation, muscular activity, injury and surgical operation greatly increase the need for Vitamin C and other essential nutrients.

The development and maintenance of good teeth and sound bones depend on adequate calcium metabolism, and

calcium is taken from other foods and retained in the body when citrus fruits are added to the regular diet. Hence, citrus fruits increase the efficiency of calcium metabolism.

In the mild deficiency states, months or years of minor ailments and ill health may precede frank deficiency manifestations; under such conditions a special strain such as pregnancy, injury or infection may precipitate acute deficiency disease.

Treatment of acute deficiency states requires concentrated and pure vitamins; in milder conditions as in health, these have no advantage over appropriate natural foods. In many instances, the latter have been shown to have superior therapeutic value, though the mechanism of their action is incompletely known. Citrus fruits are particularly useful in treatment because of their appetizing qualities and their year-round availability.

National preparedness demands optimum health throughout the entire population, and this in turn demands nutritional welfare of the highest order. Diets must be rich in the protective foods--eggs, milk products, leafy green vegetables, and the citrus fruits--in order to achieve that buoyant health which is the basis of courage and endurance.

Modern nutritional science teaches that the normal requirements for vitamins and minerals should be met through the use of natural foods. Among these, citrus fruits hold

high place. Their content of vitamins, organic acids, sugars and water, together with their final alkaline reaction in the body, makes them a valuable aid in balancing the diet; while their low cost places within the reach of the greater part of the population a supply of essential food factors upon which life depends.

CHAPTER VIII

CONCLUSION

The citrus industry has grown from small, luxury fruit shipments to a multi-million-dollar business. It has taken its place as one of the largest major agricultural industries in the United States.

The industry has had its ups and downs, and will no doubt have many more. Many of the best men in Florida are striving to find a way to dig the Florida citrus industry out of the economic quicksand into which it has fallen, and most everyone has some plan for its rehabilitation. Some of these plans, suggestions, and observations are, as follows:

At the head of the list is the so-called Maxcy plan, suggested by Latt Maxcy, prominent Frostproof grower, shipper, and canner, which is now being developed by the marketing committee of the Florida Citrus Commission, assisted by a large group that represents all phases of the industry.

Maxcy proposed that shippers, canners, and growers band into a single organization that can fix minimum sales prices for fresh and canned fruit. This is the beginning of Florida Citrus Mutual. It is proposed to set up a board of governors to establish a floor for prices on cost of production and a reasonable profit for growers.

It will be necessary for Florida Citrus Mutual to sign up at least 70 per cent of Florida's citrus crop before it can operate as a functional unit in marketing Florida's bumper crop of fruit.

It is hoped that this text will assist many young men and women in giving them an insight as to the makeup of one of the world's largest agricultural industries, and one of major importance to the growth and health of our nation.

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APPENDIX

APPENDIX A

UNITED STATES DEPARTMENT OF AGRICULTURE
WAR FOOD ADMINISTRATION

Office of Marketing Services

U. S. STANDARDS FOR CITRUS FRUITS
(Effective July 12, 1943.)

INTRODUCTION

These standards apply only to the common or sweet orange group, grapefruit, and varieties belonging to the Mandarin Group, except tangerines. These standards do not apply to tangerines or to California and Arizona citrus fruits for which separate U. S. standards are issued.

The tolerances for the standards are on a container basis. However, individual packages in any lot may vary from the specified tolerances as stated below, provided the averages for the entire lot, based on sample inspection, are within the tolerances specified.

For a tolerance of 10 per cent or more, individual packages in any lot may contain not more than one and one half times the tolerance specified, except that when the package contains 15 specimens or less, individual packages may contain not more than double the tolerance specified.

For a tolerance of less than 10 per cent, individual packages in any lot may contain not more than double the

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half times the tolerance

packages in any lot ma

tolerance

tolerance specified, provided at least one specimen which does not meet the requirements shall be allowed in any one package.

Numbers and letters in parentheses following grade terms indicate where such terms are defined under Definitions of Terms.

GRADES

U. S. FANCY shall consist of citrus fruits of similar varietal characteristics (1), which are well colored (2), firm (3), well formed (4), mature and of smooth texture (5); free from ammoniation, bird pecks, bruises, buckskin, creasing, cuts which are not healed, decay, growth cracks, scab, splitnavels, sprayburn, and undeveloped or sunken segments, from injury (6), by badly or unsightly discoloration (6), green spots or oil spots (6a), sticking (6), rough and excessively flat or protruding navels (6b), scale (6c), scars (6d), thorn scratches (6e), and from damage (10) caused by dirt or other foreign materials (10), dryness or mushy condition (10c), sprouting (10), sunburn (10i), disease, insects, or mechanical or other means (10).

In this grade not more than one-tenth of the surface in the aggregate may be affected with discoloration (7). (See Tolerances.)

U. S. NO. 1 shall consist of citrus fruits of similar varietal characteristics (1) which are fairly well colored (8), firm (3), well formed (4), mature and of fairly smooth texture (9); free from bruises, cuts which are not healed, decay, growth cracks, sprayburn, undeveloped or sunken segments, and from damage (10) caused by ammoniation (10a), bird pecks (10), buckskin (10), black or unsightly discoloration (10), creasing (10b), dirt or other foreign materials (10), dryness or mushy condition (10c), green spots or oil spots (10d), pitting (10), scab (10e), scale (10f), scars (10g), split or rough or protuding navels (10h), sprouting (10), sunburn (10i), thorn scratches (10j), disease, insects or mechanical or other means (10).

In this grade not more than one-third of the surface in the aggregate may be affected with discoloration (7). (See Tolerances.)

U. S. NO. 1 BRIGHT. The requirements for this grade are the same as for U. S. No. 1 except that no fruit may have more than one-tenth of its surface in the aggregate affected with discoloration (7). (See Tolerances.).

U. S. NO. 1, GOLDEN. The requirements for this grade are the same as for U. S. No. 1 except that not more than 30 per cent by count, of the fruits shall have in excess of one-third of the surface in the aggregate affected with

discoloration (7). (See Tolerances.)

U. S. No. 1, RUSSET. The requirements for this grade are the same as for U. S. No. 1, except that more than 20 per cent but not more than 75 per cent, by count, of the fruits shall have in excess of one-third of the surface in the aggregate affected with discoloration (7), provided that when the predominating discoloration on each of 75 per cent or more, by count, of the fruits is caused by rust mite, all fruits may have in excess of one-third of the surface affected with discoloration (7). (See Tolerances.)

U. S. No. 1, RUSSET. The requirements for this grade are the same as for U. S. No. 1 except that more than 75 per cent, by count, of the fruits shall have in excess of one-third of the surface in the aggregate affected with discoloration (7). (See Tolerances.)

U. S. No. 2, shall consist of citrus fruits of similar varietal characteristics (1) which are mature but may be only slightly colored (11), fairly firm (12), slightly misshapen (13) and slightly rough (14) but which are free from bruises, cuts which are not healed, decay, growth cracks, and free from serious damage (15) caused by ammoniation (15a), bird pecks (15), black or unsightly discoloration (15), buckskin (15b), creasing (15c), dirt or

other foreign materials (15), dryness or mussy condition (15d), green spots or oil spots (15e), [illegible] (15f), scale (15g), scars (15h), split or rough or protruding navels (15i), sprayburn (15j), scratching (15), sunburn (15k), thorn scratches (15L), undeveloped or sunken segments (15m), disease, insects, mechanical or other means (15).

In this grade not more than two-thirds of the surface in the aggregate may be affected with discoloration (7). (See Tolerances.)

U. S. COMBINATION GRADE. Any lot of citrus fruits may be designated "U. S. Combination" when not less than 40 per cent, by count, of the fruits in each container meet the requirements of U. S. No. 1 grade and the remainder U. S. No. 2 grade. (See Tolerances.)

U. S. COMBINATION NO. 1 GRADE. Any lot of citrus fruits may be designated "U. S. Combination No. 1" when not less than 40 per cent, by count, of the fruits in each container meet the requirements of U. S. No. 1 grade and the remainder U. S. No. 1 grade except that in this combination grade each fruit shall have in excess of one-third of the surface in the aggregate affected with discoloration (7). (See Tolerances.)

U. S. No. 2 Bright. The requirements for this grade are the same as for U. S. No. 1 except that no fruit may have more than one-tenth of its surface in the aggregate affected with discoloration (7). (See Tolerances.)

U. S. No. 2 Russet. The requirements for this grade are the same as for U. S. No. 1 except that not more than 40 per cent, by count, of the fruit shall have in excess of two-thirds of the surface in the aggregate affected with discoloration (7). (See Tolerances.)

U. S. No. 2, shall consist of citrus fruits of similar varietal characteristics (1) which are mature; which may be misshapen (16), slightly scaly (17), rough but not seriously lumpy for the variety or serious by creased; which are free from cuts which are not healed and from decay, and from any serious damage (18) caused by bruises (18a), growth cracks (18a), granulation (18b), rind scars (18c), sunburn (18d), melanose (18e), creasing (18f), dryness or shriveling (18g), pitting (18), scab (18h), scale (18i), split navels (18j), sprayburn (18k), windpuffs (18l), sunburn (18L), thorn punctures (18m), disease, insects, mechanical or other means (18). The fruit may be poorly colored but not more than 10 per cent of the surface of each fruit may be of a solid dark green color. (See Tolerances.)

TOLERANCES FOR PRECEDING GRADES

In order to allow for variations incident to proper grading and handling in each of the foregoing grades, the following tolerances are provided as specified:

U. S. Fancy. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of this grade, but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage; not more than one-fourth of the tolerance, or 2-1/2 per cent, shall be allowed for damage by black or unsightly discoloration; and not more than one-twentieth of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 3 per cent shall be allowed for decay enroute or at destination. No part of any tolerance shall be allowed for wormy fruit.

U. S. NO. 1, U. S. No. 1 BRIGHT, U. S. No. 2 BRIGHT. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of the grade other than for discoloration but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage, and not more than one-twentieth of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more

than 5 per cent shall be allowed for decay enroute or at destination. In addition, not more than 10 per cent, by count, of the fruit in any container may not meet the requirements relating to discoloration but not more than one fourth of this tolerance, or 2-1/2 per cent, shall be allowed for serious damage by black or unsightly discoloration. No part of any tolerance shall be allowed for wormy fruit.

U. S. NO. 1 GOLDEN and U. S. NO. 1 BRONZE. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of the grade, but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage, and not more than one twentieth of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 5 per cent shall be allowed for decay enroute or at destination. No part of any tolerance shall be allowed to reduce or to increase the percentage of fruit having in excess of one-third of the surface in the aggregate affected with discoloration which is required in the grade, but individual containers may vary not more than 10 per cent from the percentage required, provided that the entire lot averages within the percentage specified. No part of any tolerance shall be allowed for wormy fruit.

U. S. No. 1 RUSSET. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of the grade but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage, and not more than 1/20 of the tolerance or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 3 per cent shall be allowed for decay enroute or at destination. No part of any tolerance shall be allowed to reduce the percentage of fruit having in excess of one-third of the surface in the aggregate affected with discoloration which is required in this grade, but individual containers may have not more than 10 per cent less than the percentage required provided that the entire lot averages within the percentage specified. No part of any tolerance shall be allowed for wormy fruit.

U. S. NO. 2. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of this grade other than for discoloration but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage, other than by dryness or mushy condition, and not more than one-twentieth of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point provided that, a total

tolerance of not more than 3 per cent shall be allowed for decay enroute or at destination. In addition, not more than 10 per cent, by count, of the fruit in any container may not meet the requirements relating to discoloration. No part of any tolerance shall be allowed for wormy fruit.

U. S. COMBINATION GRADE. Not more than 10 per cent, by count, of the fruit in any container may be below the requirement of this grade other than for discoloration but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage other than by dryness or mushy condition, and not more than one-twentieth of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 3 per cent shall be allowed for decay enroute or at destination. In addition, not more than 10 per cent, by count, of the fruit in any container may have more than two-thirds discoloration, but not more than one-fourth of this tolerance, or 2-1/2 per cent, shall be allowed for serious damage by black or unsightly discoloration. No part of any tolerance shall be allowed to reduce for the lot as a whole the percentage of U. S. No. 1. required in the combination, but individual containers may have not more than a total of 10 per cent less than the percentage of U. S. No. 1 required or specified, provided that the entire lot averages within the percentage specified.

No part of any tolerance shall be allowed for wormy fruit.

U. S. COMBINATION RUSSET. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of this grade other than for discoloration but not more than one-half of this tolerance, or 5 per cent, shall be allowed for very serious damage, other than by dryness or mushy condition, and not more than one-twentieth, of the tolerance, or one-half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 3 per cent shall be allowed for decay enroute or at destination. In addition, not more than 20 per cent, by count, of the fruit in any container, may have less than one-third discoloration. No part of any tolerance shall be allowed to reduce, for the lot as a whole, the percentage of U. S. No. 1, except for discoloration, required in the combination, but individual containers may have not more than a total of 10 per cent less than the percentage of U. S. No. 1 except for discoloration required or specified, provided that the entire lot averages within the percentage specified. No part of any tolerance shall be allowed for wormy fruit.

U. S. NO. 2 RUSSET. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of this grade but not more than one-half of

this tolerance, or 5 per cent, shall be allowed for any serious damage other than by dryness or mushy condition, and not more than one-twentieth of the tolerance, or one half of one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 4 per cent shall be allowed for decay enroute or at destination. No part of any tolerance shall be allowed to reduce the percentage of fruit having in excess of two-thirds of the surface in the aggregate affected with discoloration which is required in this grade, but individual containers may have not more than 10 per cent less than the percentage required provided that the entire lot averages within the percentage specified. No part of any tolerance shall be allowed for wormy fruit.

U. S. NO. 2 GRADE. Not more than 10 per cent, by count, of the fruit in any container may be below the requirements of this grade but not more than one-third of this tolerance, or 3 per cent, shall be allowed for defects other than dryness or mushy condition, and not more than one-fifth of this amount, or one per cent, shall be allowed for decay at shipping point; provided that a total tolerance of not more than 4 per cent shall be allowed for decay enroute or at destination. No part of any tolerance shall be allowed for wormy fruit.

STANDARD PACK

Fruit shall be fairly uniform in size, unless specified as uniform in size, and when packed in boxes, shall be arranged according to the approved and recognized methods. When wrapped, each fruit shall be enclosed in its individual wrapper and show at least one-half twist, except that in packs of oranges of a size 250 and smaller, only fruit in the top and bottom layers and fruit exposed at the sides of the box shall be required to be wrapped.

All packages shall be tightly packed and well filled but the contents shall not show excessive or unnecessary bruising because of overfilled packages.

When packed in standard nailed boxes, oranges shall show a minimum bulge of 1-1/4 inches. With grapefruit, the minimum bulge shall be 2 inches, except that boxes packed with grapefruit of a size 80 or smaller need only show a bulge of 1-1/2 inches.

"Fairly uniform in size" means that not more than a total of 10 per cent, by count, of the fruit in any container is outside the range given below for various packs:

DIAMETER IN INCHES

ORANGES

Pack:	Minimum:	Maximum:
96's	3 - 6/16	3 - 13/16
126's	3 - 3/16	3 - 10/16
150's	3 -	3 - 16/16
176's	2 - 14/16	3 - 4/16

DIAMETER IN INCHES - Cont'd.

ORANGES

Pack:		Minimum:	Maximum:
	200's	2 - 12/16	3 - 2/16
	216's	2 - 10/16	3 -
	250's	2 - 8/16	2 - 14/16
	288's	2 - 6/16	2 - 12/16
	324's	2 - 4/16	2 - 10/16

GRAPEFRUIT

Pack:		Minimum:	Maximum:
	36's	5 -	5 - 8/16
	46's	4 - 11/16	5 - 4/16
	54's	4 - 6/16	4 - 15/16
	64's	4 - 3/16	4 - 12/16
	70's	3 - 15/16	4 - 8/16
	80's	3 - 12/16	4 - 5/16
	96's	3 - 9/16	4 - 2/16
	112's	3 - 7/16	4 -
	126's	3 - 5/16	3 - 14/16

"Uniform in size" means that not more than 10 per cent by count of the fruits in any container vary more than the following amounts:

Grapefruit: 64 size and smaller - not more than 6/16-inch in diameter.

54 size and larger - not more than 9/16-inch in diameter.

Oranges: 150 size and smaller - not more than 4/16-inch in diameter.

126 size and larger - not more than 5/16-inch in diameter.

In order to allow for variations, other than sizing, incident to proper packing, not more than 5 per cent of the packages in any lot may not meet the requirements of standard pack.

DEFINITIONS OF TERMS

As used in these Standards:

1. "Similar varietal characteristics" means that the fruits in any container are similar in color and shape.

2. "Well colored" as applied to grapefruit means that the fruit is yellow in color with practically no trace of green color; as applied to oranges of the common and Mandarin Groups, means that the fruit is yellow or orange in color with practically no trace of green color.

3. "Firm" as applied to grapefruit and oranges, means that the fruit is not soft, or noticeably wilted or flabby; as applied to oranges of the Mandarin Group (Satsumas, King, Mandarin), means that the fruit is not badly puffy, although the skin may be slightly loose.

4. "Well formed" means that the fruit has the shape characteristic of the variety.

5. "Smooth texture" means that the skin is thin and smooth for the variety and size of fruit.

6. "Injury" means any defect or blemish which more than slightly affects the appearance, edible or shipping quality of the fruit. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect shall be considered as injury:

(a) Green spots or oil spots, when appreciably affecting the appearance of the individual fruit.

(b) Rough and excessively wide or protruding navels, when protruding beyond the general contour of the orange; or when flush with the general contour but with the opening so wide, considering the size of the fruit, and the navel growth so folded and ridged that it detracts noticeably from the appearance of the orange.

(c) Scale, when more than a few adjacent to the "button" at stem end, or when more than 6 scattered on other portions of the fruit.

(d) Scars, when causing roughness of the fruit texture to a greater degree than is permitted under the term "smooth" as required in the grade; or when the scars affect the appearance of the fruit to a greater extent than the maximum of discoloration allowed in the grade.

(e) Thorn scratches, when the injury is not slight, not well healed, or more unsightly than discoloration allowed in the grade.

7. "Discoloration" means russeting of a light shade of golden brown caused by rust mite or other means. Lighter shades of discoloration caused by superficial scars or other means may be allowed on a greater area, or darker shades may be allowed on a lesser area, provided, no discoloration caused by melanose or other means may affect the appearance of the fruit to a greater extent than the

shade and amount of discoloration allowed for the grade.

8. "Fairly well colored" means that except for one inch in the aggregate of green color, the yellow or orange color predominates over the green color on that part of the fruit which is not discolored.

9. "Fairly smooth texture" means that the skin is fairly thin and not coarse for the variety and size of fruit.

10. "Damage" means any defect or injury which materially affects the appearance, edible, or shipping quality of the fruit. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect shall be considered as damage;

(a) Ammoniation, when not occurring as light speck type similar to melanose.

(b) Creasing when causing the skin to be materially weakened.

(c) Dryness or mushy condition when affecting all segments of oranges and grapefruit more than one-fourth inch at the stem end or all segments of varieties of the Mandarin Group more than one-eighth inch at the stem end, or more than the equivalent of these respective amounts, by volume, when occurring in other portions of the fruit.

(d) Green spots or oil spots, when materially affecting the appearance of the individual fruit.

(e) Scab, when it cannot be classed as discoloration, or affects shape or texture.

(f) Scale, when it materially affects the appearance of the fruit.

(g) Scars, when causing roughness of the fruit texture to a greater degree than is permitted under the term "fairly smooth" as required in the grade; or when these scars affect the appearance of the fruit to a greater extent than the maximum of discoloration allowed.

(h) Split or rough or protruding navels, when any split is unhealed, or more than three well-healed splits at the navel, or any split which is more than one-fourth inch in length; or three-cornered, star-shaped or other irregular navels when the opening is so wide, considering the size of the orange, and the navel growth so folded and ridged that it detracts materially from the appearance of the orange; or navels which flare, bulge, or protrude beyond the general contour of the orange to the extent that they are subject to mechanical injury in the process of proper grading, handling and packing.

(i) Sunburn, when the area affected exceeds 25 per cent of the fruit surface, or when the skin is appreciably flattened, dry, darkened, or hard.

(j) Thorn scratches, when the injury is not well healed, or concentrated light colored thorn injury which has caused an area of more than an average of 1/4-inch in diameter if the skin is broken hard, or light scratches when light colored and concentrated and averaging more than one inch in diameter, or dark colored thorn injury which detracts from the appearance of the fruit to a greater extent than the amounts specified above.

11. "Slightly colored" means that except for a [illegible] inch in the aggregate of green color, the portion of the fruit surface which is not discolored shows some yellow or orange color.

12. "Fairly firm" as applied to grapefruit means that the fruit may be slightly soft, but not bruised, and the skin may be thick and slightly puffy; as applied to oranges, means that the fruit may be slightly soft, but not bruised; as applied to oranges of the Mandarin Group (Satsumas, King, Mandarin) means that the skin of the fruit is not badly puffy or extremely loose.

13. "Slightly misshapen" means that the fruit is not of the shape characteristic of the variety but is not decidedly elongated or pointed, or otherwise badly deformed.

14. "Slightly rough texture" means that the skin is not of smooth texture but is not badly ridged, badly grooved, or badly wrinkled.

15. "Serious damage" means any defect or injury which seriously affects the appearance, edible or shipping quality of the fruit. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect shall be considered as serious damage;

(a) Ammoniation, when scars are cracked, or when dark and aggregating more than three-fourths inch in diameter or when light colored and aggregating more than 1-1/4 inches in diameter.

(b) Buckskin, when aggregating more than 25 per cent of the fruit texture is seriously affected.

(c) Creasing, when so deep or extensive that the skin is seriously weakened.

(d) Dryness or mushy condition when affecting all segments of oranges and grapefruit more than 1/2-inch at the stem end, or all segments of varieties of the Mandarin Group more than 1/4-inch at the stem end, or more than the equivalent of these respective amounts by volume when occurring in other portions of the fruit.

(e) Green spots or oil spots, when seriously affecting the appearance of the individual fruit.

(f) Scab, when it cannot be classed as discoloration, or when materially affecting shape or texture.

(g) Scale, when it seriously affects the appearance

of the individual fruit.

(h) Scars, when causing roughness of the fruit texture to a greater degree than is permitted under the term "slightly rough" as stated in this grade; or when the scars affect the appearance of the fruit to a greater extent than the maximum of discoloration allowed in this grade.

(i) Split or rough or protruding navels, when any split is unhealed, or one-half inch split at each corner of irregular navels when any one is more than one-half inch in length, or when aggregating more than one inch in length, or when more than four in number; or navels which protrude beyond the general contour of the orange to the extent that they are subject to mechanical injury during the process of proper grading, handling and packing, or irregular navels when the opening is so wide, considering the size of the orange, and the navel growth so badly folded and ridged that it detracts seriously from the appearance of the orange.

(j) Sunburn which seriously affects the appearance of the fruit or is hard, or when more than 1-1/4 inches in diameter in the aggregate has a light brown discoloration.

(k) Sunburn which affects more than one-third of the fruit surface, or is hard, or the fruit is decidedly one-sided, or when more than 1-1/4 inches in diameter in the aggregate has a light brown discoloration.

(l) Thorn scratches, when the injury is not well healed, or concentrated light colored thorn injury which has caused an area of more than an average of 1/8-inch in diameter of the skin to become hard, or slight scratches when light colord and concentrated, averaging more than 1-1/2 inches in diameter, or dark or scattered thorn injry which detracts from the appearance of the fruit to a greater extent than the amounts specified above.

(m) Undeveloped or sunken segments, in navel oranges, when such segments are so sunken or undeveloped that they are readily noticeable.

16. "Misshapen" means that the fruit is decidedly elongated, pointed or flat sides.

17. "Slightly spongy" means that the fruit is puffy or slightly wilted but not flabby.

18. "Very serious damage" means any defect or injury which very seriously affects the appearance, edible, or shipping quality of the fruit. Any one of the following defects, or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect shall be considered as very serious damage:

(a) Growth cracks that are seriously weakened, gummy or not healed.

(b) Ammoniation, when aggregating more than two inches in diameter, or which has caused serious cracks.

(c) Bird pecks, when not healed.

(d) Caked melanose, when more than 25 per cent in the aggregate of the surface of the fruit is caked.

(e) Buckskin, when rough and aggregating more than 50 per cent of the surface of the fruit.

(f) Creasing, when so deep or extensive that the skin is very seriously weakened.

(g) Dryness or mushy condition, when affecting all segments of oranges and grapefruit more than 1/4 inch in the stem end, or all segments of varieties of the Mandarin Group more than 1/4 inch at the stem end, or more than the equivalent of these respective amounts by volume when occurring in other portions of the fruit.

(h) Scab, when aggregating more than 25 per cent of the surface of the fruit.

(i) Scale, when covering more than 20 per cent of the fruit surface or the equivalent of this amount when scattered over the surface of fruit.

(j) Split navels, when not healed or the fruit is seriously weakened.

(k) Sprayburn, when seriously affecting more than one-third of the fruit surface.

(l) Sunburn, when seriously affecting more than one-third of the fruit surface.

(m) Thorn punctures, when not healed or the fruit is seriously weakened.

CULL

A Cull is a fruit which does not meet the requirements of U. S. No. 3 grade.

STANDARD FOR INTERNAL QUALITY OF COMMON SWEET ORANGES
(Citrus Sinensis (L.) Osbeck)

Any lot of oranges, the juice content of which meets the following requirements, may be designated "A Quality Juice":

(1) The amount of juice shall be at the following rate:

Each lot of fruit of size 176 and smaller, as defined in the U. S. Standards for Citrus Fruits, shall have not less than four and one-half gallons, and each lot of fruit of size 150 and larger shall have not less than four gallons of juice per standard packed box of one and three-fifths bushels.

(2) The averages for any lot shall be not less than nine per cent total soluble solids, and not less than one-half of one per cent anhydrous citric acid or more than the maximum acid specified in Table 1, provided that individual oranges may have not less than eight per cent solids, and not less than four-tenths of one per cent acid or more than two-tenths of one per cent above the specified average maximum per cent of acid shown in Table 1.

In order to allow for variations incident to proper grading, not more than 10 per cent, by count, of the oranges in any lot may fail to meet the requirements specified for individual oranges; provided, however, that the lot as a whole meets the averages specified.

The juice used in determinations of solids, acid, and juice content shall be extracted by hand without the use of any kind of mechanical pressure or device, and shall be strained through a double thickness of gauze having 44 x 40 threads per square inch.

TABLE 1. Minimum ratios of total soluble solids to anhydrous citric acid for "A Quality Juice". The per cent of anhydrous citric acid shown in this table opposite the total soluble solids is the maximum anhydrous citric acid permissible for the corresponding total soluble solids.

Total Soluble Solids Per Cent	Maximum Anhydrous Citric Acid Per Cent	Minimum Ratio of Total Soluble Solids to Anhydrous Citric Acid
	FOR INDIVIDUAL ORANGES	
8.0	.800	10.00-1
8.1	.814	9.95-1
8.2	.828	9.90-1
8.3	.843	9.85-1
8.4	.857	9.80-1
8.5	.872	9.75-1
8.6	.887	9.70-1
8.7	.902	9.65-1
8.8	.917	9.60-1
8.9	.932	9.55-1

Total Soluble Solids - Al[illegible] [illegible]	Maximum Amount Nitric Acid [illegible]	Minimum Ratio of Total Soluble Solids to Amount of Nitric Acid
9.0	.947	1.00-1
9.1	.968	1.00-1
9.2	.979	1.00-1
9.3	.990	1.00-1
9.4	1.011	1.00-1
9.5	1.027	0.00-1
9.6	1.042	1.00-1
9.7	1.058	0.95-1
9.8	1.077	0.90-1
9.9	1.094	0.85-1
10.0	1.111	0.80-1
10.1	1.128	0.75-1
10.2	1.146	0.70-1
10.3	1.164	0.65-1
10.4	1.181	0.60-1
10.5	1.200	0.75-1
10.6	1.218	0.70-1
10.7	1.237	0.65-1
10.8	1.256	0.60-1
10.9	1.275	0.55-1
11.0	1.294	0.50-1
11.1	1.306	0.50-1
11.2	1.318	0.50-1
11.3	1.330	0.50-1
11.4	1.341	0.50-1
11.5	1.353	0.50-1
11.6	1.365	0.50-1
11.7	1.378	0.50-1
11.8	1.382	0.50-1
11.9	1.400	0.50-1
12.0	1.41	0.50-1
12.1	1.424	0.50-1
12.2	1.435	0.50-1
12.3	1.447	0.50-1
12.4	1.459	0.50-1
12.5	1.471	0.50-1
12.6	1.48	0.50-1
12.7	1.494	0.50-1
12.8	1.506	0.50-2
12.9	1.517	0.50-1
13.0	1.530	0.50-1
13.1	1.541	0.50-1
13.2	1.554	0.50-1
13.3	1.562	0.50-1

Total Soluble Solids - AVERAGE PER CENT	Maximum Anhydrous Citric Acid AVERAGE PER CENT	Minimum Ratio of Total Soluble Solids to Anhydrous Citric Acid
12.4	1.378	8.50-1
12.5	1.388	8.50-1
12.6	1.400	8.50-1
12.7	1.412	8.50-1
12.8	1.424	8.50-1
12.9	1.435	8.50-1
13.0	1.447	8.50-1
13.1	1.459	8.50-1
13.2	1.471	8.50-1
13.3	1.482	8.50-1
13.4	1.494	8.50-1
13.5	1.506	8.50-1
13.6	1.518	8.50-1
13.7	1.529	8.50-1
13.8	1.541	8.50-1
13.9	1.553	8.50-1
14.0	1.565	8.50-1
14.1	1.576	8.50-1
14.2	1.588	8.50-1
14.3	1.600	8.50-1
14.4	1.612	8.50-1
14.5	1.624	8.50-1
14.6	1.635	8.50-1
14.7	1.647	8.50-1
14.8	1.659	8.50-1
14.9	1.671	8.50-1
15.0	1.682	8.50-1
15.1	1.694	8.50-1
15.2	1.706	8.50-1
15.3	1.718	8.50-1
15.4	1.729	8.50-1
15.5	1.741	8.50-1
More than 15.5.		8.50-1

APPENDIX B

Florida Citrus Mutual

The Florida Citrus Mutual was organized to correct conditions which have caused heavy losses to shippers and canners and reduced the net returns of growers below production costs.

We believe and are confident that if all branches of the industry can be united and will devote their best talents to the success of such an organization, we can be saved from the economic disaster which appears inevitable if we continue in the present disorganized state.

The Board recognized from the beginning that the plan and purposes must fairly and equitably serve all, and so win the united support essential to success. It has, therefore, constantly studied the situation and has made changes in the original plan to improve the service intended.

Analysis of Florida Citrus Conditions and Plans to Improve them.

These facts are known to all. It will suffice for the present to summarize them by stating the conclusions of all the citrus interests, shippers, canners and growers alike and of businessmen and bankers, which is: That the industry is, or in the 1948-49 season will be, in such

desirable condition or will help gain it. Many directly engaged in it will threaten the health economy of the entire State. Therefore, without exception, all agree that unity of the citrus industry must be accomplished if the above results are to be prevented.

NECESSARY CORRECTIVE MEASURES:

(1) Standardization of quality of the product--both fresh and processed.

(2) Better market organization and merchandising.

(3) Surplus diversion to the extent one can be or ineffective.

(4) Control of fruit handled by both fresh fruit shippers and processors.

(5) Stabilization of market to yield adequate returns to growers, processors and shippers.

(6) Aid in the effective advertising of Florida citrus fruit both fresh and processed.

(7) Adopt a trademark for its members.

(8) Encourage and foster such consolidation of sales agencies as may be found desirable.

(9) Unite the industry, grower, shipper and processor in one organization which can speak and act effectively in all matters of concern to the general Florida economy and particularly in the interest of the citrus

industry need and is [illegible] other circumstances.

These corrective measures can progressively and effectively be applied through Florida Citrus Mutual which meets the following important tests:

(1) It is of unquestioned validity under the Capper-Volstead Act.

( ) It is broad enough in its charter powers and sufficiently practical, to fairly, efficiently and equitably serve the best interests of growers, shippers and processors.

(3) It does offer the best means of securing the necessary 75% sign-up.

Florida Citrus Mutual also provides for eligibility to membership of all citrus growers, whether owning, packing and processing facilities or not, and provides for a shippers' and growers' protective committee. This meets the essential requirements we have listed above.

ANSWERS ---

--- to some of your questions.

"If I become a member of Mutual, can I sell my fruit on the tree as in the past?"

"Yes, just as you have always done, except that you agree to sell or market only through handlers, who have contracts with Mutual."

"Does every Mutual grower have a vote?"

"Yes, the control of Mutual is by the votes of its grower members in the election of the Board of Directors. Every grower, large or small, has one vote."

"How is the Board of Directors elected?"

"In each of the seven citrus commission districts, Mutual grower members will meet annually and elect two directors making a total of fourteen, elected from the districts. These fourteen will be a nominating committee and will present names to the growers attending the State annual meeting of Mutual, who will elect seven directors. These, with the fourteen elected in the districts, will make a total of twenty-one directors."

"How will Mutual operate through its Board of Directors and its Executive Committee?"

"The Executive Committee will be thirteen shippers and canners nominated by the handlers of Mutual and elected by the Board of Directors. These will be men skilled in selling and marketing with the experience and 'know how' to develop workable control plans equitable to both growers and shippers which will give Florida citrus growers intelligent marketing and distribution of their products."

"When will the first election of Directors be held?"

"As soon as 75% of the fruit is signed on grower contracts, an election will be held and the present Board will be replaced by the newly-elected grower board."

"When will Mutual begin to operate?"

"Just as soon as 75% or more of the fruit is signed on grower contracts. This should be as soon as possible and if growers will sign promptly, it may be in operation at the beginning of the 1948-49 season. This is the reason why you should sign now and work to persuade other growers to sign immediately.

If I sign now, what assurance have I that my packer or buyer will sign?"

"This is an old question of 'which will come first, the hen or the egg?' You need your packer and your packer needs you, because packing houses need fruit just as fruit needs packing houses. With 75% signed up, you are assured of ample shipping facilities. Many packers and canners have already contracted with Mutual and others are signing up. Your packer is just as much interested in the benefits to be derived from a united industry as you are."

"My $5.00 membership fee, how will that be used?"

"This is a good question. This membership fee is for carrying on all the expenses of organization of Mutual; travel, printing, telephone, telegraph, office help, etc."

"Does Mutual control Express shipments?"

"No. Mutual contracts do not cover Florida citrus fruit or products used for home consumption, or small quantities disposed of for local consumption, or fruit shipped by Express or sold to Express shippers. Your contract contains these exceptions.

For answers to any other questions you may have, write to the MUTUAL OFFICES, 410 CITRUS CENTER BUILDING, LAKELAND, FLORIDA.

FIGURE I

ORANGE CYCLE FROM TREE TO CONSUMER

No. I

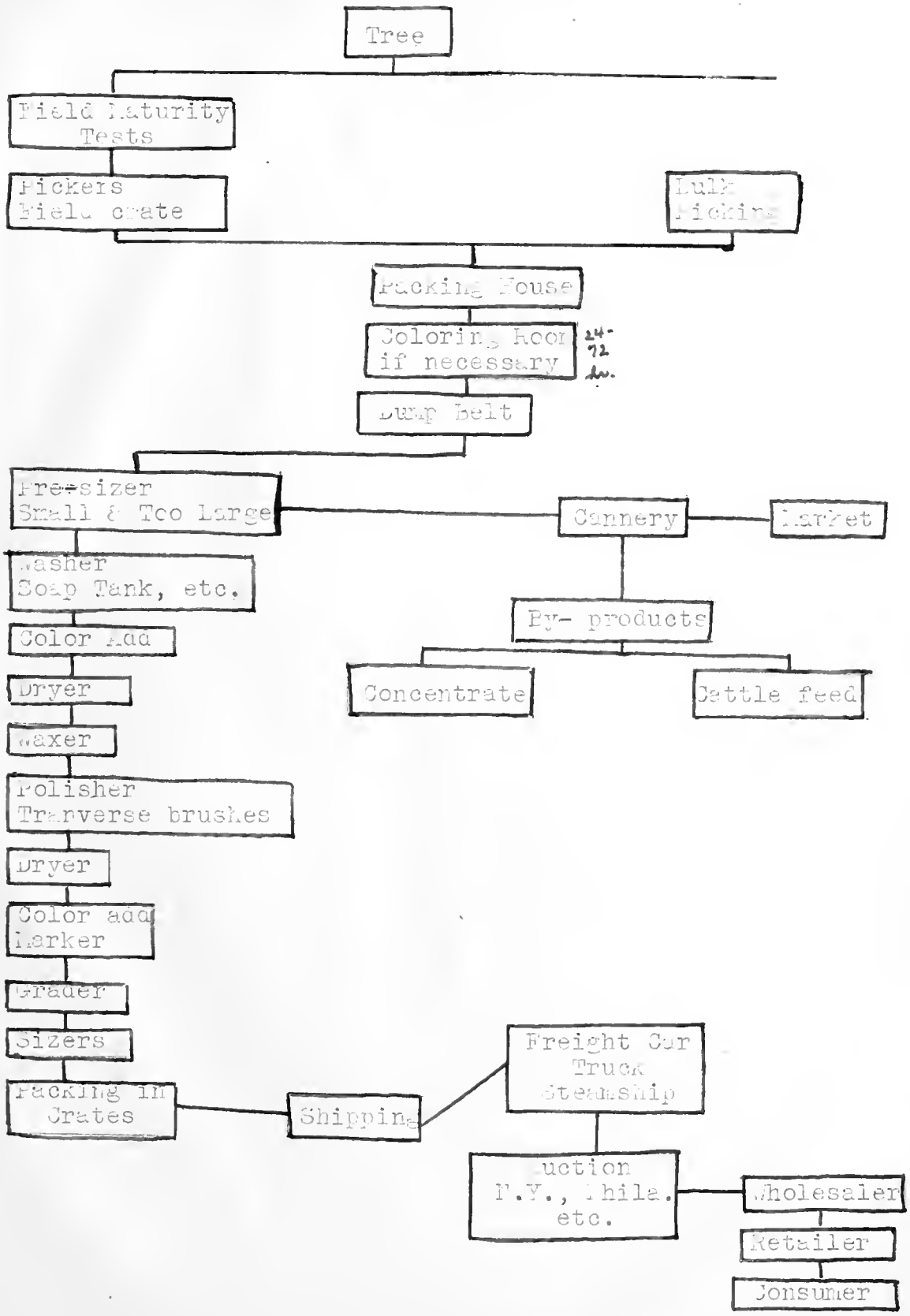
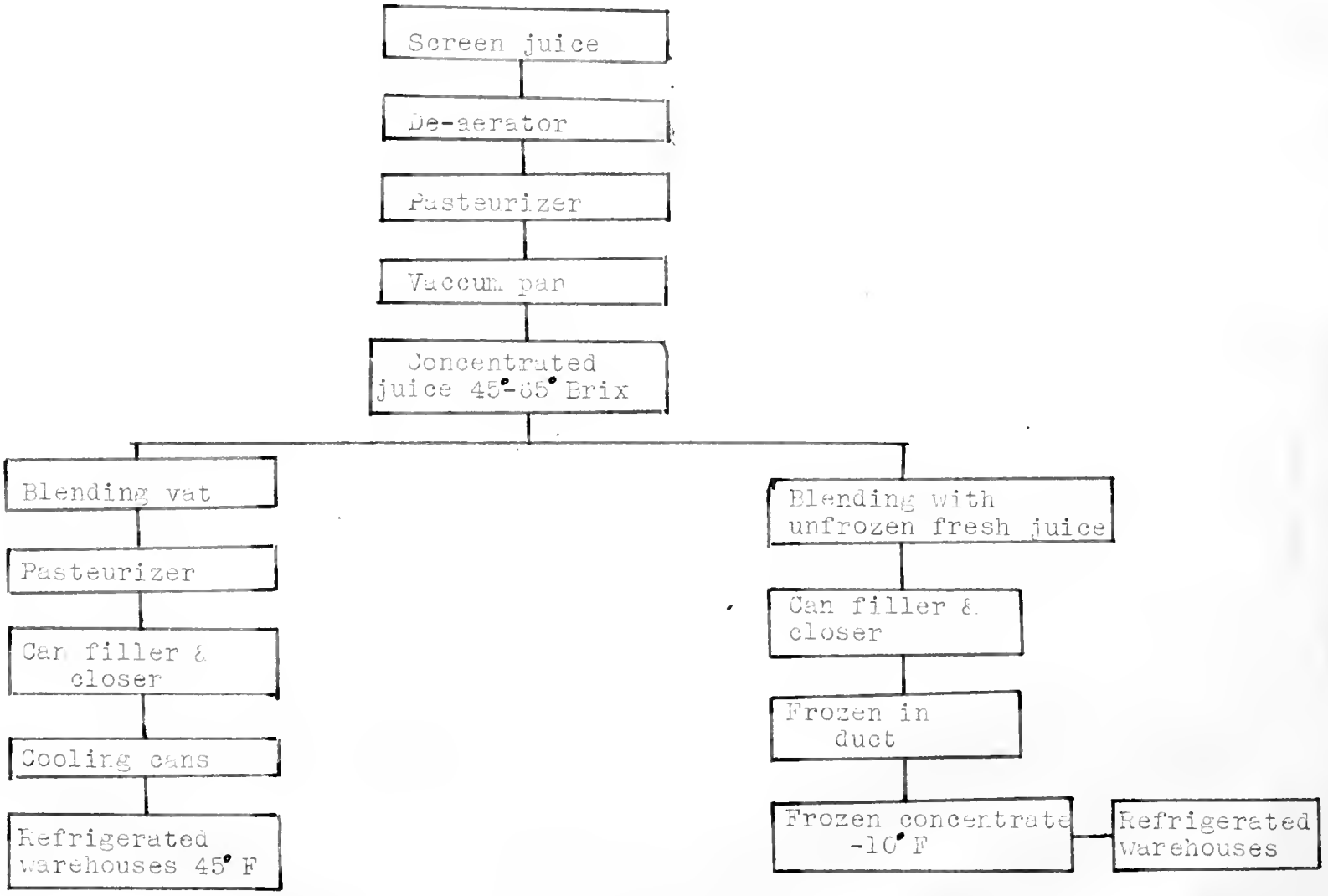


FIGURE II

MANUFACTURING JUICE CONCENTRATES



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Lakeland, Florida

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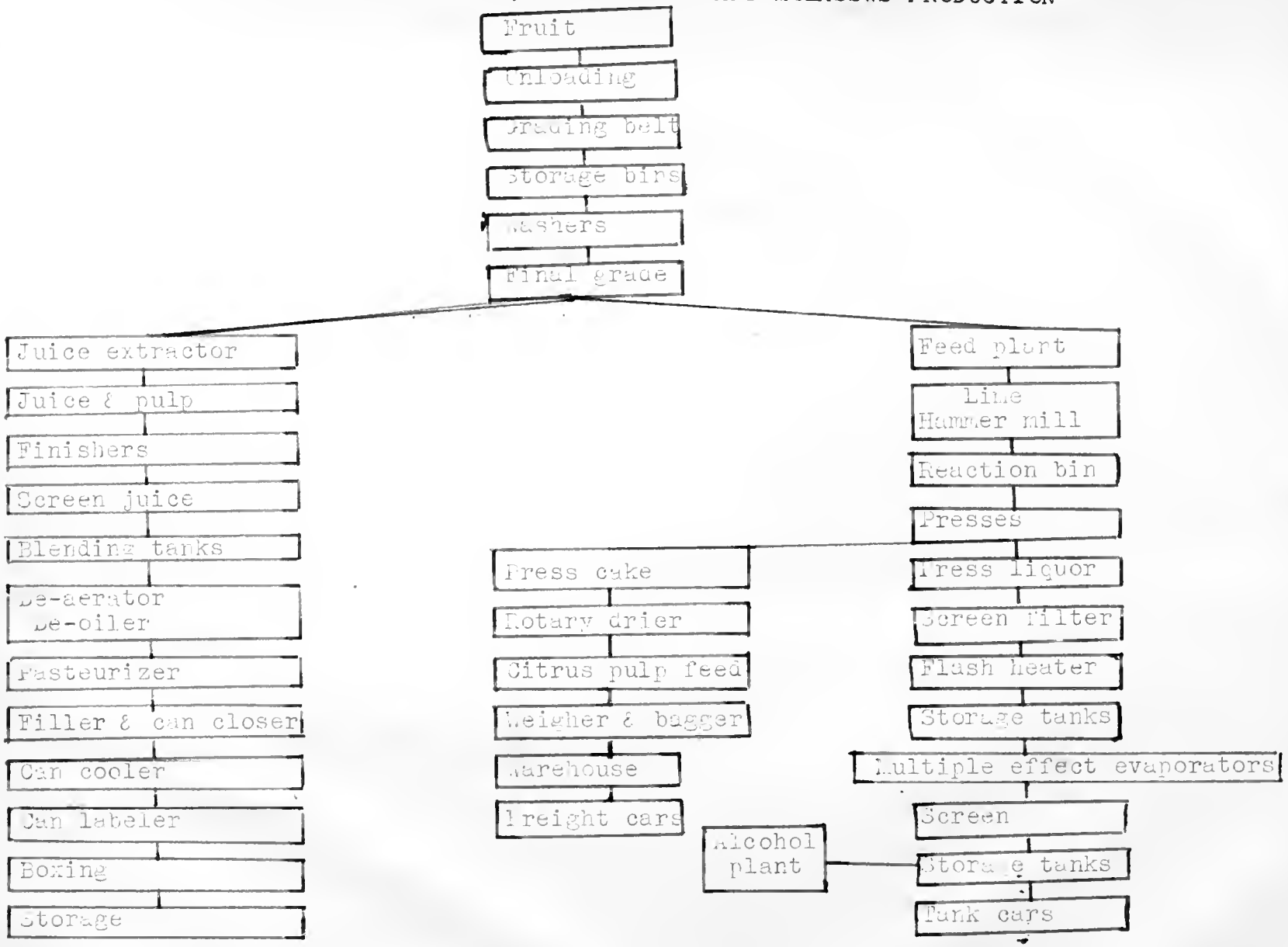
FIGURE III

FLOW SHEET FOR CANNING, CATTLE FEED AND MOLASSWS PRODUCTION



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